Office of the Assistant Secretary of Defense

for

Sustainment

Department of Defense

Annual Energy Management and

Resilience Report (AEMRR)

Fiscal Year 2018

June 2019

COST ESTIMATE

The estimated cost of this report for the Department of Defense is approximately $273,000 in Fiscal Years 2018–2019. This includes $211,000 in expenses and $61,000 in DoD labor. Cost estimate generated on April 30, 2019 / RefID: 1-9DD052E

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1. Introduction

The chief priority of the Department of Defense (DoD) energy policy is to ensure mission readiness of the armed forces by pursuing energy security and energy resilience. In today's technology-dependent environment, energy requirements are inseparable from the Department's mission requirements, whether discussing weapons platforms or the installations and systems that support those capabilities around the globe. As such, energy resilience, which enables the capabilities of weapons platforms, facilities, and equipment, is a critical investment that must be part of the Department's research, acquisition, operations, and sustainment conversations.

An important opportunity exists for the Department to improve its installation energy resilience posture at the Department's 500 installations worldwide. The nearly 300,000 buildings, covering 1.9 billion square feet, on these installations account for nearly 30 percent of DoD's total energy use[1]. Aligning installation energy requirements directly to mission and readiness requirements, agnostic of specific technologies or practices, is the Department's key opportunity to improve energy resilience. Increasing efficiencies, lowering costs, and enhancing backup power options all have significant impact on energy resilience when implemented as part of a comprehensive energy strategy focused on maintaining mission-essential functions in the face of system disruption or stress. The Department will ensure energy resilience and reliability for critical missions while treating installation energy as a force multiplier in support of military readiness.

The Annual Energy Management and Resilience Report (AEMRR) details the Department's Fiscal Year (FY) 2018 performance toward achieving greater energy resilience across its installation enterprise. Additionally, this AEMRR will discuss the Department's efforts to achieve the statutory energy management requirements outlined in title 10 U.S.C. § 2925(a). Figure 1 summarizes the Department's progress toward its FY 2018 energy goals. While the DoD has made progress towards these statutory goals, continued focus and effort is required.

[1] Installation energy includes energy needed to power fixed installations and enduring locations as well as non-tactical vehicles (NTVs), whereas operational energy is the energy required for training, moving, and sustaining military forces and weapons platforms for military operations and training—including energy used by tactical power systems and generators at non-enduring locations.

Goals & Objectives	Metric	Component	FY 2018	Goal
Consume More Electric Energy From Renewable Sources 42 U.S.C. § 15852(a)	Total renewable electricity consumption as a percentage of total facility electricity consumption.	**DoD**	**5.88%**	7.5%
		ARMY	**8.02%**	
		NAVY	**2.73%**	
		USMC	**10.79%**	
		USAF	**6.79%**	
Produce Or Procure More Energy From Renewable Sources 10 U.S.C. § 2911(g)	Total renewable energy (electric & non-electric) produced or procured as a percentage of total facility electricity consumption.	**DoD**	**15.76%**	25% by 2025
		ARMY	**17.00%**	
		NAVY	**29.42%**	
		USMC	**15.73%**	
		USAF	**7.29%**	

Figure 1: FY 2018 Progress Toward Installation Energy Goals

The FY 2018 AEMRR is compiled based upon the following mandates:

- Section 548 of the National Energy Conservation Policy Act (NECPA) of 1978 (42 U.S.C. § 8258) which requires Federal agencies to describe their energy management activities;
- Title 10 U.S.C. § 2925, which requires DoD to submit to Congress an AEMRR describing its installation energy activities;
- Title 10 U.S.C. § 2911(c)(1), which requires DoD to establish energy performance goals for transportation systems, support systems, utilities, and infrastructure and facilities;
- Title 10 U.S.C. § 2688 (g)(4), which requires DoD to report progress in meeting energy resilience metrics for all utility conveyance contracts entered into.

This report also responds to the following reporting requirements:

- Senate Report 115-262, page 150, accompanying S. 2987, the John S. McCain National Defense Authorization Act (NDAA) for FY 2019) (Appendix E)
  - Establishment of the energy resilience project development and implementation office
- Senate Report 115-269, page 8, accompanying S. 3024, the Military Construction, Veterans Affairs, and Related Agencies Appropriations Bill, 2019 (Appendix F)
  - Critical energy systems outside DoD property
- Section 2880 of the NDAA for FY 2018 (P.L. 115-91) (Appendix G)
  - Energy Security for military installations in Europe

The compliance matrix in Appendix B illustrates all reporting requirements satisfied by this report.

2. Installation Energy Program Management

Office of the Deputy Assistant Secretary of Defense for Energy (ODASD(Energy))

The Assistant Secretary of Defense for Sustainment (ASD(Sustainment)) serves as the principal staff assistant and advisor to the Under Secretary of Defense for Acquisition & Sustainment (USD(A&S)), Deputy Secretary of Defense (DEPSECDEF), and Secretary of Defense (SECDEF) on logistics and materiel readiness in the DoD and is the principal logistics official within the senior management of the DoD.

Within the Office of the Assistant Secretary of Defense for Sustainment (OASD(Sustainment)), the Office of the Deputy Assistant Secretary of Defense for Energy (ODASD(Energy)) is responsible for issuing energy policy and guidance to DoD Components; coordinating DoD energy strategies; overseeing energy programs (e.g., energy resilience, operational energy, and distributed and renewable energy); and engaging with the Military Services, Defense Agencies, and other stakeholders. Additionally, ODASD(Energy) coordinates all congressional reports related to the Department's energy programs.

Army

The Army's energy, water, and sustainability programs fall under the purview of the Assistant Secretary of the Army for Installations, Energy and Environment (ASA(IE&E)).

Using guidance provided by the Office of the Assistant Chief of Staff for Installation Management (OACSIM), landholding Army Commands monitor their progress relative to strategic energy security and sustainability goals and take necessary actions to improve performance. The Army periodically reevaluates metrics to foster a culture of continual process improvement. To further the alignment of energy and water performance to mission performance, the Army continues to integrate energy and water security into total Army readiness. Improving access to reliable and secure energy and water resources supports strategic resource management goals.

The Army's Energy Security and Sustainability (ES^2) Strategy fosters more adaptable and resilient installations that are prepared for a future defined by complexity, uncertainty, adversity, and rapid change. The ES^2 has served as a foundational driver for more detailed policy articulating the Army's evolving stance on energy and water resilience. In FY 2017, the Army Directive 2017-07 (*Installation Energy and Water Security Policy*) coupled with the *Energy and Water Goal Attainment Responsibility Policy for Installations* formalized the host of legacy energy and water management requirements, specifying their application to the Army. These two Army policy documents underscore effective energy and water management that results in energy and water resilience to ensure Army mission readiness in a rapidly changing world.

Department of the Navy (DoN)

The Assistant Secretary of the Navy for Energy, Installations and Environment (ASN(EI&E)) is the designated senior DoN official for energy responsible for formulating Department-wide policies, procedures, advocacy, and strategic plans, as well as overseeing all DoN functions and programs related to installation, energy, and water resilience. The Deputy Assistant Secretary of the Navy for Installations & Facilities (DASN(I&F)) is the principal advisor to ASN(EI&E). Within the Secretariat, the Director, Installation Resilience facilitates the DoN Installation Energy Policy Board, which brings together the senior Navy and Marine Corps officials for energy, water, and installation resilience strategy and policy decisions. The larger DoN energy community consists of a broad range of subject matter experts, analysts, and program managers.

The Office of the Chief of Naval Operations (CNO) Shore Installation Management Division (OPNAV N46) is responsible for developing policy and programming resources for the Navy's Facility Energy Program. OPNAV N46 also ensures compliance with DoN shore energy goals. The Commander, Navy Installations Command (CNIC) is the shore integrator, responsible for current and future shore energy and water requirements across warfare enterprises. CNIC N4 (Facilities and Environmental Department), N44 (Base Operations Support (BOS) Programs), N441 (Energy and Utilities Branch), and the Energy Headquarters Program Director (Energy, HPD) are responsible for developing and integrating energy requirements across the Shore Enterprise.

The Naval Facilities Engineering Command (NAVFAC) provides technical and business expertise for facilities, utilities, energy, and other infrastructure support services to the Navy and Marine Corps and serves as the Navy's technical authority for the cybersecurity of facility-related control systems (FRCS). The Assistant Commander for Public Works at NAVFAC Headquarters serves as the NAVFAC Energy Officer and oversees the development of relevant energy guidance, standards, processes, and internal policy to NAVFAC. Within NAVFAC, the Resilient Energy Program Office (PW8) mission is to deliver installation energy security solutions to provide access to efficient, resilient, and reliable energy optimizing use of private and appropriated funds.

The Deputy Commandant for Installations and Logistics (DC I&L) is responsible for establishing energy and water management policy for United States Marine Corps (USMC) installations in accordance with the Commandant's direction. The Assistant Deputy Commandant for Installations and Logistics (Facilities) serves as the single point of contact responsible for program management and resourcing. The Commander, Marine Corps Installations Command (COMMCICOM) oversees program planning and execution with direct support provided by the MCICOM Facilities Director (MCICOM G-F). The Energy and Facility Operations Section (MCICOM GF-1) serves as the Marine Corps Installations Energy Program Manager.

Air Force

Each component of the Air Force Energy Team plays an important role in striving to meet the Service-wide energy priorities to improve resilience, optimize demand, and assure supply. These priorities support the Air Force vision of "enhance mission assurance through energy assurance," which steers the Air Force toward facility energy that is resilient, cost-effective, and cleaner.

The Assistant Secretary of the Air Force for Installations, Environment and Energy (SAF/IE) provides guidance, direction, and oversight for all matters pertaining to the formulation, review, and execution of plans, policies, programs, budgets, and Air Force positions regarding federal and state legislation and regulations related to energy and water use. Oversees and monitors all Air Force energy programs. Establishes Air Force energy direction, strategy, policy, and priorities and oversees implementation of analytical methods to integrate energy considerations into all Air Force business processes.

Headquarters Air Force (HQ USAF) provides information to support governance and oversight of energy management activities. Provides procedures and objectives to address and manage Air Force facility energy and water consumption, throughput, and requirements in alignment with policies and strategic direction. Develops policies, guidance, procedures, and practices to enhance Air Force energy assurance with the goal of energy resilience, and ensure a state of energy security to meet mission essential requirements.

The Air Force Installation and Mission Support Center (AFIMSC) and its primary subordinate unit, Air Force Civil Engineer Center (AFCEC) develops and executes facility energy programs, plans, and policies in support of Air Force strategic energy priorities and goals, integrated with Major Command mission requirements. Assesses energy use and risks to identify investment opportunities and efficiency measures to enhance capability and mission success. Provides guidance on energy project development, utility recommendations and requirements validation, capabilities oversight and resource advocacy, and oversight and guidance on budgeting and execution funding. Promotes policies, procedures, and practices to enhance Air Force energy security and resilience. Develops standardized processes for facility energy program. Provides assistance to installations to meet energy goals and objectives.

The Air Force Office of Energy Assurance (OEA) develops, implements, and oversees an integrated facility energy portfolio, including privately financed, large-scale, clean energy projects that will provide uninterrupted access to the energy necessary for mission success.

Installation personnel develop installation energy and water plans to support or supplement Air Force energy goals/strategies, execute those plans, measure and evaluate their base energy usage and costs, promote total energy awareness, and nominate successful people and units for energy awards. Installation energy managers provide daily management and oversight of the installation's

energy plans, energy awareness, education and training, audits, utility billing, and energy and water consumption reporting.

Air Force energy governance provides guidance and oversight of given developments in technology, shifts in resource availability, and changes in operational requirements. By its governance structure integrating energy management across mission areas and implementing cross-functional strategies and policies, the Air Force can improve its operational capabilities and maximize its fiscal resources. Air Force energy governance is in transition, but will comply with revised draft Air Force Policy Directive 90-17, *Energy Management*.

Defense Agencies

The Defense Agencies continue to enhance their Installation Energy Management Programs and each agency has a designated Senior Energy Official to administer their respective program (Table 1).

Table 1: Defense Agencies Senior Energy Officials

DoD Component	Senior Energy Official
Defense Contract Management Agency (DCMA)	Energy Program Manager
Defense Commissary Agency (DeCA)	Energy Program Manager
Defense Finance and Accounting Service (DFAS)	Director, Support Services
Defense Intelligence Agency (DIA)	Chief, Engineering and Logistics Officer
Defense Logistics Agency (DLA)	Installation Management Director
Missile Defense Agency (MDA)	Environmental Executive
National Reconnaissance Office (NRO)	Director, Management Services and Operations
National Geospatial-Intelligence Agency (NGA)	Director, Installation Operations Office
National Security Agency (NSA)	Chief of Facilities and Infrastructure Services
Washington Headquarters Services (WHS)	Pentagon Energy Program Manager

The Intelligence Community (IC), in particular, has adopted a community-wide approach to maximizing energy opportunities. Within the Office of the Director of National Intelligence there is an IC Energy Management Working Group composed of representatives from the intelligence agencies with the subject matter expertise and authority to speak for their agency on energy matters.

3. Energy Resilience

Section 101(e)(6) of title 10 U.S.C. defines "energy resilience" as "the ability to avoid, prepare for, minimize, adapt to, and recover from anticipated and unanticipated energy disruptions in order to ensure energy availability and reliability sufficient to provide for mission assurance and readiness, including mission essential operations related to readiness, and to execute or rapidly reestablish mission essential requirements." Energy security is defined by section 101(e)(7) of title 10 U.S.C. as "having assured access to reliable supplies of energy and the ability to protect and deliver sufficient energy to meet mission essential requirements." The DoD defines availability and reliability in the FY 2017 "Energy Resilience: Operations, Maintenance, & Testing (OM&T) Strategy and Implementation Guidance." Availability is "the availability of an item – under combined aspects of its reliability, maintainability, and maintenance support – to perform its required function at a stated instant of time or over a stated period of time." Reliability is "the ability of a component or system to perform required functions under stated conditions for a stated period of time." Energy resilience includes both availability and reliability as well as two additional critical parameters: (1) resilience includes the capability to adapt to a changing environment in order to maintain or rapidly reestablish mission-essential functions in the face of anticipated and unanticipated disruptions; and, most important, (2) resilience is targeted at ensuring the readiness of military installations.

DoD relies primarily on commercial power to conduct missions from its installations. Commercial power supplies can be threatened by a variety of events ranging from natural hazards and physical attacks on infrastructure, to cyber-attacks on its networks and supervisory control and data acquisition (SCADA) systems. DoD recognizes that such events could result in power outages affecting critical DoD missions involving power projection, defense of the homeland, or operations conducted at installations in the United States directly supporting warfighting missions overseas. The Department is working to understand and address the vulnerabilities and risk of power disruptions that can impact mission readiness[2].

Energy resilience can be enhanced in a variety of ways, including redundant power supplies; identification and isolation of mission-critical power loads and associated circuitry; integrated or distributed fossil, alternative, or renewable energy technologies; microgrid applications including storage; diversified or alternate fuel supplies; upgrading, replacing, operating, maintaining, or testing current energy generation systems, infrastructure, and equipment; as well as mission alternative such as reconstitution or mission-to-mission redundancy. DoD is agnostic toward specific technologies and practices that are employed to achieve energy resilience; mission capability concerns override preferences toward specific technology implementation goals. An

[2] DoD publishes the status of its energy resilience program at the following: http://www.acq.osd.mil/eie/IE/FEP_Energy_Resilience.html.

important aspect of energy resilience is to establish an iterative planning and implementation cycle in which mission owners conduct a risk analysis and specify requirements, infrastructure stakeholders solve for the specified requirements, and the process repeats itself as needed to meet changing mission parameters.

New Energy Resilience Reporting Requirements

New statutory requirements require DoD to track and report on energy resilience metrics and efforts to work towards minimizing installation energy disruptions and consequently maintain mission readiness. These requirements are reflected in updated language to title 10 U.S.C. § 2925, title 10 U.S.C. § 2911, and title 10 U.S.C. § 2688 (Appendix B). For example, under title 10 U.S.C. § 2925(a)(4) DoD is required to report the amount (MW), downtime tolerance, and emergency backup generation of each installation's critical energy loads among other data points. DoD does not yet possess critical load data at this level of detail for every installation. However, ODASD(Energy) is actively working with the DoD Components to identify and implement best practices to gather and report against these new requirements. The Department is working toward guidance that provides instructions to the DoD Components on how to collect and report against these revised statutory resilience reporting requirements. This guidance will focus both broadly on energy resilience and more specifically on items such as the risks inherent with failure to meet Operations, Maintenance, and Testing (OM&T) requirements and recommendations. In addition to incorporating lessons learned from Department efforts, guidance updates will also leverage the lessons learned from the Services' current internal efforts to quantify and report resilience requirements. The following sections provide more specific details regarding the ongoing efforts of the Department and Services to achieve energy resilience.

Office of the Secretary of Defense (OSD) Energy Resilience

As part of its energy resilience focus, DoD continues to adapt policies and guidance related to energy infrastructure. In FY 2016, DoD updated DoD Directive (DoDD) 4180.01, "DoD Energy Policy," and DoD Instruction (DoDI) 4170.11, "Installation Energy Management" to reflect the Department's focus on energy resilience. DoDI 4170.11 specifically requires DoD Components to identify their critical energy requirements and ensure both primary and emergency energy generation systems are available to serve these critical loads. While these fundamental elements of energy resilience are not yet fully captured for all installations across the Department, ODASD(Energy) is pursuing the collection of this data through issuing updated guidance and helping DoD Components execute against this guidance. In FY 2017, the DoD published the "Energy Resilience: Operations, Maintenance, and Testing (OM&T) Strategy and Implementation Guidance" that outlines an OM&T energy resilience strategy, including development of an implementation plan that replaces or improves emergency power generation readiness, reduces system maintenance, and improves fuel flexibility to ensure the supportability of all Department emergency power generation systems in operation. These updates served as a foundation for

continuing to refine policies and guidance in FY 2018 and prompted ODASD(Energy) to pursue efforts focused on energy resilience.

Policy Updates

Installation Energy Plan (IEP) Guidance

In May 2018, the Assistant Secretary of Defense for Energy, Installations and Environment (ASD(EI&E)) released updated guidance for DoD Installation Energy Plans (IEPs). IEPs are a foundational element for the Department's implementation of energy resilience solutions, regardless of whether the solutions are technology- or behavior-based. IEPs are the integration of applicable strategic guidance, plans, and policies into a comprehensive roadmap that will enable installations to work constructively towards goals and requirements in energy resilience. Based on recognized master planning guidance in Unified Facilities Criteria (UFC) under Series 2, Master Planning, IEPs will take into account and address each installation's current and future energy and water demand required to sustain critical mission operations; goals set by Congress, the White House, DoD, or relevant Component; total operating costs; and requirements/concerns regarding cybersecurity for FRCS. Leveraging input from all installation tenant organizations, IEPs direct a structured and effective approach to selecting, prioritizing, sequencing and implementing energy projects and programs that ultimately result in better long-term installation energy performance and a stronger energy resilience posture.

The FY 2018 update to the original FY 2016 guidance revised the implementation timelines and parameters to increase focus on critical mission operations and provided more thorough guidance regarding cybersecurity. In FY 2019, the DoD Components will complete IEPs for all of the installations listed on the Office of the Deputy Assistant Secretary of Defense for Defense Continuity and Mission Assurance (ODASD(DC&MA)) priorities installations list. In FY 2020, the DoD Components will complete IEPs for all installations that account for 75 percent of their Component's total installation energy. By the end of FY 2021, IEPs shall be completed for all remaining installations that were not included in the prior years. All IEPs must address cybersecurity requirements applicable to their respective energy projects, including any installation or modification of Operational Technology (OT) encompassing Platform IT (PIT), Control Systems (CS), or FRCS.

In early calendar year (CY) 2019, the DoD Components briefed IEP implementation plans to DASD(E). The DoD Components are actively pursuing IEPs at their respective installations in accordance with the timeline requirements laid out in the FY 2018 guidance.

ESPC/UESC Guidance

The Department is authorized to pursue Energy Savings Performance Contracts (ESPC) and Utility Energy Service Contracts (UESC) under title 42 U.S.C. 8287 and title 10 U.S.C. 2913(d) respectively. The "Policy on Energy Savings Performance Contracts and Utility Energy Service

Contracts" effective November 20, 2018 provides guidance on how to use these funding mechanisms to enhance energy resilience on DoD installations. It requires executing ESPCs and UESCs in a manner consistent with existing DoD policies on energy resilience (i.e., DoDI 4170.11, "Energy Resilience: Operations, Maintenance, and Testing (OM&T) Strategy and Implementation Guidance," IEP policy); a cybersecurity plan accompany each project; and maintenance, repair, and replacement (MR&R) requirements be implemented to improve the long-term success of these contracts.

Utilities Privatization (UP) Guidance

The UP authority granted under title 10 U.S.C. § 2688 enables the Department to leverage commercial capital and best practices to improve and sustain utility system reliability in support of critical warfighter readiness and lethality requirements. The "Supplemental Guidance for the Utilities Privatization Program" effective February 7, 2019 strengthens the Department's energy security posture by providing policy on closing critical cybersecurity and energy resilience gaps pursuant to law, and in alignment with the National Defense Strategy (NDS). Utility systems conveyed in whole or in part to a private entity must operate in an energy resilient and cyber-secure manner and will be held to the same standard as utility systems owned and operated by the Department. Title 10 U.S.C. § 2688(g)(4) requires DoD to describe its progress in meeting energy resilience metrics for conveyance contracts it has entered into. As of this writing, DoD has not yet established metrics to hold private entities accountable for ensuring energy resilience is maintained when utility systems are conveyed. However, the UP supplemental guidance requires conveyees to operate, maintain, and test applicable generation systems, infrastructure, and equipment in compliance with DoD requirements.

Lines of Effort

Energy Resilience Exercises

Since 2016, in collaboration with ODASD(Energy), the Massachusetts Institute of Technology – Lincoln Labs (MIT-LL) has visited 27 DoD installations to understand their current energy resilience posture and to outline recommendations for increased energy resilience. During these site visits, MIT-LL collected a variety of energy resilience information and at some locations, conducted Energy Resilience Table-Top Exercises (ER TTXs) or Energy Resilience Readiness Exercises (ERREs). ER TTXs are tabletop exercises that assess an installation's ability to respond to different utility disruption scenarios. ERREs are real-world exercises whereby power is turned off to all or part of an installation to assess the energy resilience posture of the installation. These exercises help installations understand their energy resilience risk of energy disruptions and identify infrastructure interdependencies that may not be apparent during routine OM&T.

In FY 2018, the Department conducted four ER TTXs and two ERREs at DoD installations. The Department is encouraged by the outcomes of these exercises. Although each exercise highlighted areas where the respective installation has vulnerabilities or incorrect assumptions, the exercises have also enabled constructive engagement between mission owners and tenants on current

resilience posture and have guided investments that will be outlined in IEPs. In FY 2019, the Department will continue to conduct these exercises, focusing primarily on installation-wide electricity outages at contiguous United States (U.S.) (CONUS) and outside continental U.S. (OCONUS) installations. In addition to enabling installations to understand their energy resilience postures, these exercises will yield a standardized exercise format that the Services can leverage in future FYs to conduct their own exercises targeted at installations in accordance with Service-specific resilience planning.

Energy Resilience Assessment (ERA) Tool

The ERA Tool identifies an energy resilience baseline for military installations in terms of the life-cycle cost and amount of unserved load associated with the current design of the utility system. It then explores alternative resilient energy technology combinations (referred to as "architectures") capable of meeting the mission required electrical loads. This analysis of alternatives provides a method for comparing different technologies across their life-cycle cost and performance in meeting electrical loads, a common roadblock when evaluating competing project proposals. The tool examines over one hundred potential architectures that include both centralized and distributed energy solutions, diesel and natural gas generation, solar photovoltaics, energy storage, and fuel cells.

The ERA Tool also determines reliability metrics and performs system reliability modeling for these different generation sources. The reliability metrics are an input to the Monte Carlo simulation engine that allows the DoD to predict the amount of unserved load (the availability or resilience metric) for the critical energy loads identified at each military installation. The ERA Tool compares the life-cycle cost predictions and availability (energy resilience metric) of different potential energy resilience solutions at each military installation. This allows mission owners and installation personnel to determine how much they are willing to spend to achieve different levels of energy resilience.

Energy Resilience Project Funding

The Energy Resilience and Conservation Investment Program (ERCIP)

The ERCIP spending authority (10 U.S.C. § 2914) and associated Military Construction (MILCON) funding carve-out is one of the Department's targeted energy resilience investment strategies. The Energy Conservation and Investment Program (ECIP) was initiated in FY 2007 with a $35 million appropriation for investments in energy and water conservation projects. The FY 2016 NDAA added "Resilience" to ECIP, and changed the program to ERCIP, expanding investments to include energy resilience, availability, and reliability. In FY 2017, Congress appropriated $150 million for ERCIP, which the Department used to fund 41 projects across DoD Components. The resilience projects have also shown that they are a good financial investment: the average savings-to-investment ratio (SIR) for the FY 2017 ERCIP portfolio was 2.1 and the projects averaged a 7.3 year payback period. Since 2017, Congress has funded the Department's

annual ERCIP request of $150 million, and in some years legislators have added funding for additional projects ($15 million was added in FY 2018, and $43.4 million was added in FY 2019). ERCIP provides a tremendous benefit to the Department, offering installations the opportunity to fund energy resilience projects without competing directly for dollars against other priorities within the broader MILCON appropriations.

The Department prioritizes projects based on several criteria including:

a) The project's contribution to mission readiness at prioritized installations;
b) The project's inclusion in a holistic energy plan for a given installation, region, department, or Component;
c) The Component's prioritization of their projects;
d) The project's SIR and simple payback period (SPP);
e) The project's synergistic integration of multiple technologies related to energy/water savings, monitoring, renewable energy generation, and energy resilience/security;
f) Whether the project implements a technology validated in a demonstration program, such as the Environmental Security Technology Certification Program (ESTCP) or other similar test bed programs, or a technology that represents significant improvement over existing technology; and
g) Expected energy and water use reductions as a result of the project.

Non-Federal Financing of Energy Resilience Projects

There are several authorities which enable the Department to leverage private financing for energy projects. Third-party (or "alternative") financing is available through Power Purchase Agreements (PPAs), Enhanced Use Leases (EULs), Utilities Privatization (UP), UESCs, and ESPCs.

The Defense Energy Resilience Bank (DERB)

Despite the Department's extensive experience in leveraging alternative financing authorities, DoD has limited insight into the how the financial industry and lender organizations view risk for energy resilience projects. This lack of insight may be detrimental to the Department and Components' ability to craft project proposals that provide clear financial benefits for non-federal financing institutions and lenders. The Department is currently undertaking a study to leverage its ERA Tool, developed by MIT-LL, and an increased understanding of the financial industry's risk calculus to develop an energy resilience business case framework that allows stakeholders and decisions makers in government and the private sector to consider wide-scale adoption of alternative financing for energy resilience projects on DoD installations. It is the intent of the Department to migrate this business case framework into the ERA Tool, thereby creating a platform with the capability to not only identify installation-level resilience solutions, but also propose clear options for appropriations and alternative financing strategies to achieve the identified solutions.

Energy Resilience Technology and Infrastructure Solutions

A variety of technical solutions have the potential to promote energy resilience in the form of energy generation and infrastructure hardening for DoD missions on fixed installations. Current technology and equipment solutions include, but are not limited to, small backup generation units, microgrids, large scale solar photovoltaic arrays, energy storage systems, co-generation plants, and distribution system hardening. The following technologies are being pursued by the Department to enhance energy resilience and mission readiness on DoD installations.

- *Backup Generators*
  Diesel generators dominate backup power needs across all installations and provide a reliable power source if and when they are sufficiently maintained and fueled. Uninterruptable power supplies are also commonly used to bridge the generator startup time for critical loads that cannot experience brief power outages. However, multiple analyses conducted by both the OSD and the Components have shown that many installations would both increase energy resilience and save costs by removing generators connected to non-critical loads, clustering critical loads to consolidate generation when oversized units have been installed, and performing adequate testing as described by manufacturer's recommendations and the DoD OM&T guidance.

- *Microgrids*
  Once a fundamental resilience baseline is implemented on an installation, other energy technologies enabled by a microgrid can be considered to further increase resilience (and in some cases, reduce expenses). Microgrids enable multiple power sources to be connected through the power distribution system, while allowing the installation to isolate, or island, its power system. Depending on the microgrid architecture, they can also maintain power with outages at one or more power sources, assuming functional capacity is still sufficient, or loads are appropriately prioritized. They can also save fuel by only running the generation assets required to meet the current or expected loads, though this functionality requires an understanding of installations loads and some advanced planning for large load swings. Examples of long-established and successful microgrids at DoD installations include Naval Base Guam Telecommunications Site (NBGTS) Finegayan, Guam and the Marine Corps Air and Ground Combat Center (MCAGCC) Twentynine Palms, CA. However, microgrids are not a simple plug and play solution; cooperation with local utilities, an understanding of mission-critical functions and their associated load demand, customized engineering to match operation requirements, and large capital investments are required to ensure successful implementation of this technology.

- *Distributed Power Generation and Energy Storage*
  Installations in locations with significant solar or wind resources can consider using these renewable energy sources in an islandable mode when the main utility grid fails to reduce fuel consumption and improve energy resilience. Solar photovoltaic (PV) arrays or wind farms in combination with an islandable inverter can produce significant power without requiring a fuel supply chain. Since solar and wind power is intermittent, significant usage of renewable power typically requires adequate and properly sized energy storage systems.

While energy storage can increase grid reliability and smooth power fluctuations, round trip efficiency will increase total energy used on site and add capital and maintenance expenses. Currently, much of the existing deployed solar PV on DoD installations is installed without islanding capability, preventing use as a true resilience solution.

- *Prime Power Co-Generation and Natural Gas*
  Prime power co-generation plants can provide much or all of an installations' electricity requirements. These plants may be cost-effective where natural gas prices are low and grid power prices are high, but will incur a significant capital expense and require dedicated staff to operate and maintain them. When an integrated natural gas pipeline is available, multi-fueled backup generators should also be considered. This will not only minimize the on-base main fuel storage requirement, but also enable the installation to continue operations in the event of an extended outage that has disrupted the external liquid fuel supply chain.

- *Distribution System Hardening*
  Improving installation energy resilience often focuses on backup power generation when the commercial grid experiences a disruption. However, emergency power generation assets are ineffective if the surrounding distribution system is unable to convey power between the generation asset and final point of use. Upgrading distribution system equipment such as switches, power lines, and transformers may be pursued as a standalone solution if backup generation is already adequate, or an integrated solution when new backup power generation assets are implemented.

- *Developing Technologies*
  Other new energy technologies (e.g., fuel cells, flywheels, advanced microgrids, etc.) may have a significant future impact for energy resilience on DoD installations. While DoD funding should continue to be allocated for research and development, these systems must be thoroughly tested before wide-scale integration. Premature rollout is extremely expensive, resource intensive, and is likely to fail quickly, increasing the possibility of residual damage to the installation and power distribution system. Recently small and very small modular nuclear reactors (SMRs and vSMRs, respectively) have received substantial attention from both industry and government stakeholders. This technology is still very early in development and the DoD will continue to monitor its progress. Like with many other new technologies, external partners can provide significant resources and expertise to the Department from development to deployment.

To reiterate, the Department is agnostic towards which specific technology solution is implemented to address an installation's energy resilience gaps, so long as it enhances mission readiness and the installation's ability to maintain or rapidly reestablish mission-critical functions. Collaboration between installation and mission personnel is critical in order to implement an appropriate solution. Collaboration between these groups will ensure new assets are properly sized to requirements and cybersecurity, maintenance, and testing requirements are accounted for. As the complexity of solutions increases, particularly solutions leveraging less established technologies, the challenges of integrating these technologies into existing physical and cyber

infrastructure increases, and the need for close communication between installation and mission personnel becomes even more paramount.

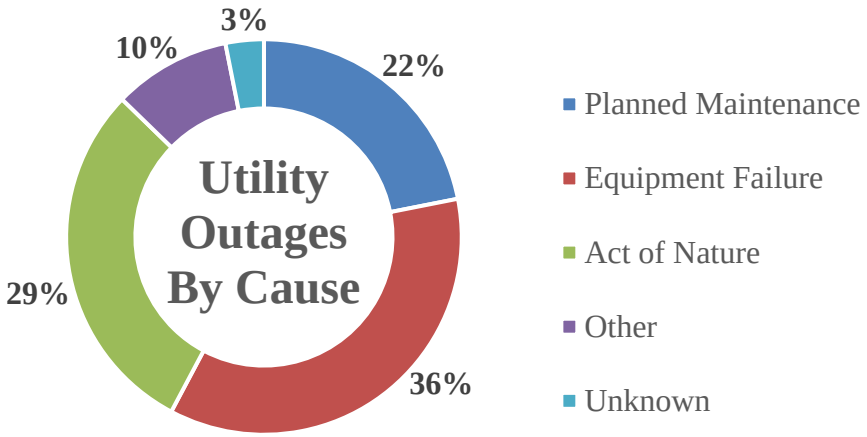
Utility Outages

Section 2925(a)(3) of title 10 U.S.C. requires the annual reporting of utility outages at military installations. In FY 2018, DoD Components reported 562 utility outages that lasted eight hours or longer, a decrease from the 1,205 events reported in FY 2017. Electrical disruptions account for the majority of these utility outages (88 percent).

Of the 562 reported outage events lasting longer than eight hours, the Services provided financial impacts for 223 of the events. The combined length of outages for these 223 events was 1,695 days; the estimated financial impact of these outages was $23,342,102 ($13,771 per outage day). In FY 2019, DoD will continue to refine its outage data collection techniques and future AEMRRs will reference the impact of outages accordingly.

As in previous years' reporting, FY 2018 mitigation efforts associated with DoD utility outages included upgrading infrastructure, increasing servicing efforts with local utilities, and pursuing emergency or redundant power supplies such as backup generators. These utility outages were caused by acts of nature (e.g., weather, storms), equipment failure (e.g., reliability or mechanical issues), planned maintenance, or some other event (e.g., vehicle accidents causing power outages or operator error). In FY 2018, 36 percent of the reported utility outages were caused by equipment failure, 22 percent were caused by planned maintenance, 29 percent were caused by acts of nature, and ten percent were considered "other" since they did not fall under these categories. The remaining three percent of reported utility outages did not specify a cause.

Figure 2: FY 2018 Utility Outages by Cause



Energy Resilience in the Services

Army

Installations and their missions to train, mobilize, and deploy are at risk for energy and water service disruptions caused by both natural and manmade events. Recognizing this link, the Army has pivoted its installation energy and water programs and projects to support the readiness of its installations.

In addition to Congressional and DoD requirements for energy security and resilience, in February 2017, the Army issued Army Directive 2017-07 (Installation Energy and Water Security Policy), which requires the Army to plan for and support energy and water requirements across four attributes:

- Critical Mission Sustainment (CMS) or the Army's ability to sustain continuity of operations for a minimum of 14 days;
- Assured Access or the dependable energy supply required for mission requirements;
- Infrastructure Condition or the ability of Army installations to reliably meet onsite mission requirements;
- System Operation or the planning and personnel needed conduct required energy and water security system planning and sustainment.

In July 2018, the Army issued Installation Energy and Water Plan (IEWP) guidance to provide an actionable pathway for installations to map their current state of resilience and to integrate courses of action to improve their site security posture in context of broader master planning trends and initiatives. The Army's installation energy and water resilience metrics, captured in the Installation Status Report – Mission Capacity (ISR-MC), have been developed to align directly with the requirements in Directive 2017-07. This measurement framework provides the basis for the IEWP requirement.

Additionally, select garrisons have undertaken resilience exercises to better understand Army installation ability to respond to an actual loss of energy and/or water service. Lessons learned during these exercises will drive follow-on corrective actions designed to improve coordination and planning efforts, as well as design projects to improve the energy and water resilience of Army installations.

ISR-MC

During FY 2018, the Army continued to refine methods for measuring and reporting energy and water security at installations through the ISR-MC database. ISR-MC provides a standard platform for evaluating Army installation energy and water security posture to inform decision-making.

Aligned with the *Installation Energy and Water Security Policy*, corrective actions recommended for FY 2018 included encouraging onsite production and island-able capabilities. These efforts directly addressed the FY 2017 reality that more than a third of respondents lacked any form of onsite energy generation.

CMS scores were leveraged to prioritize energy and water assessments and projects across existing program areas to meet the 14-day requirement for sustaining critical missions. As of the end of FY 2018, energy and water security assessments sponsored by the Deputy Assistant Secretary of the Army for Energy and Sustainability (DASA(E&S)), had been undertaken at Fort Bliss and Fort Hood, TX; Fort Polk, LA; and Joint Base Lewis-McChord (JBLM), WA. Heading into FY 2019, plans are under way to leverage energy and water security assessment findings to facilitate IEWP development for Bliss, Hood, and JBLM, which are all FY 2019 priority installations.

During FY 2018, Army ISR-MC installation baseline ratings spearheaded development of management and implementation policies and standardized guidance toward achieving energy and water security for critical missions on Army installations. Such efforts are expected to improve future ISR-MC performance. Continued progress with respect to these activities will facilitate future data-driven decision-making that directly supports mission assurance objectives.

Critical Mission Sustainment at Power Projection Platforms (PPPs) and Mobilization Force Generation Installation (MFGIs)

In FY 2018, Fort Knox was the sole Army MFGI or PPP to meet the energy-related CMS requirement in Directive 2017-07. In FY 2018, three MFGIs or PPPs achieved the water requirement: Fort Drum, USAG Ansbach, and USAG Hawaii. In addition, the Army projects both Fort Bliss and Fort Hood to meet both the energy and water CMS requirements by FY 2022.

Notable Army Initiatives

Installation level initiatives with local utility partners are an important avenue for securing power to enable continued support of critical missions. One notable project is the Schofield Barracks, HI, 50 MW biofuel project that became operational in May 2018. This alternative energy project will provide Schofield Barracks, Field Station Kunia, and Wheeler Army Airfield with secure resilient energy generation during emergencies. The project includes a 35-year land lease to Hawaiian Electric Company (HECO), with a 10-year renewal option. As the only firm power generation facility on Oahu located above the tsunami inundation zone, this project provides a "black start" capability and enhances grid resilience to benefit both U.S. Army Garrison (USAG) Hawaii and the surrounding civilian community. HECO developed, financed, designed, constructed, and maintains the plant, which will run on a mixture of biofuel and conventional fuel. The Army's formal operating agreement with HECO states that in the event of a grid outage, Schofield Barracks, Wheeler Army Airfield, and Field Station Kunia will have the first access to power. Once the Army verifies they can receive power following the outage, HECO is contractually obligated to provide 32 MW of power within 2 hours, which is the peak load of the three USAG Hawaii installations served. Supply assurance projects like this 50 MW biofuel project are cost effective given the Army does not pay a premium for contingency operations, which is a requirement the Army considers when leasing land to commercial utility partners.

Utility Outages

The Army experienced 98 utility outages in FY 2018 lasting eight hours or longer. Of those outages, 31 were due to an act of nature, 30 to equipment failure, 18 to planned maintenance, 19 to other causes. The majority of outage events (64) were disruptions to electricity. The Army will continue to track utility outage events so the information can be used to identify trends and enable targeted investment towards energy resilience solutions. The Army seeks to decrease the number of unplanned utility disruption events to improve mission assurance.

DoN

The DoN must conduct critical missions during disruptions to the commercial electrical grid. With the issuance of the DoN Installation Energy Security Framework in FY 2017, the Services focused on an examination of energy resilience predominantly as it pertained to critical facilities and access to emergency power and/or storage, while simultaneously analyzing overall benchmarks for external and internal grid reliability via System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI) data. This data-intensive effort was undertaken to engage the energy community at the local level to collect data, assess, and gather insight on the overall energy security of the installations.

Utilities outage information was one component factored into the energy security assessments conducted in FY 2018. With the integrated approach formalized by the DoN's Installation Energy Security Framework, the DoN enhanced its processes for analyzing and prioritizing limited resources in order to take advantage of multiple funding streams and acquisition tools moving forward. This included establishing an Energy Mission Integration Group (EMIG) which will enable the Navy to provide reliable, safe, and secure energy to its most important shore enterprise assets, and prioritize and execute energy projects in a holistic, enterprise-wide manner. The EMIG consists of members from various systems commands (SYSCOMS) across the enterprise and is responsible for prioritizing energy security gaps, determining the most effective solutions, and awarding funds for energy project execution. In FY 2018, the EMIG aggregated energy security gap inputs from the installation and region level into an enterprise-wide list of energy gaps and their associated missions. Going forward in FY 2019, the first prioritization of energy security gaps across the Navy will be finalized and the first set of projects will be identified. Additionally, the Marine Corps completed Energy Security Assessments (ESA) for each installation, utilizing the existing Mission Assurance Assessment program to evaluate energy resilience and reliability factors against critical mission requirements. These assessments identified vulnerabilities in existing utility infrastructure, staffing, training, and processes that support mission essential tasks and critical installation services. The ESA recommendations are being prioritized and incorporated into various investment programs by MCICOM as resources become available.

Energy resilience, reliability, and efficiency were also advanced in FY 2018 through continued progress in the Navy's Smart Grid implementation. Smart Grid is a centralized monitoring and control system used to analyze facility operations data, display the information to users, and generate actionable information. The Smart Grid Program is employing a four-step process: 1) cyber secure existing control systems, 2) connect secured control systems to a centralized network, 3) analyze data from an operation center, and 4) provide supervisory control capability of connected systems. This process results in capabilities include the following:

- Common Operating Picture (COP): Standard graphical user interface facilitates the rapid deployment of training for operators throughout the enterprise.
- Condition-Based, Predictive Maintenance: Captures physical assets' performance data and analyzes real-time diagnostics to improve performance, reducing operation costs.
- Automated Fault Detection and Diagnostics: Uses pre-programmed rules to evaluate equipment and system performance, identifying potential issues and highlighting opportunities for improved efficiency.
- Supervisory Control: Allows energy demand management analytics to manage electric loads.
- Advanced Analytics: Enables identification of patterns to draw conclusions, notify stakeholders, and, if desired, proactively correct issues in building or utility control systems.

The Navy is deploying Smart Grids at its nine regions. The Smart Grid program prioritized fleet concentration areas and high energy consuming facilities for initial integration. Navy Region Mid-Atlantic completed initial operational capability (IOC) in October 2018. The next planned Smart Grid IOC deployment is scheduled for Navy Region Southwest in mid-2019. All remaining regions will see Smart Grid IOC by the end of calendar year 2020.

The DoN remains committed to improving the energy security posture of its installations through a holistic perspective that will continue to drive future actions to ensure the DoN has the tools and data necessary for resource optimization. This will allow the DoN to direct funding to address the prioritized physical and cyber vulnerabilities of the grid, an aging system of electrical infrastructure, and changing load demands at the installation level.

Notable DoN Initiatives

Marine Corps Air Station (MCAS) Yuma Arizona (EUL): The concept of maximizing the advantages of various acquisition mechanisms with the three-pillar approach to energy security is also supported by examples across the DoN. USMC and Arizona Public Service (APS) developed a 25 MW microgrid at MCAS Yuma, AZ that began commercial operation in December 2016. In exchange for using DoN land for the microgrid site, the local utility agreed to provide in-kind consideration in the form of backup power to the base during grid outages. During normal operating conditions, APS uses the generators of the microgrid to provide grid stabilization and peak power generation capability for the utility grid. In return, the system constantly monitors the commercial grid and forecasts both outages and frequency events and will start up autonomously, providing guaranteed base-wide backup power for the duration of the outage. This creates a smooth transition from grid power to the base's own microgrid power, and prevents MCAS Yuma from experiencing any disruption to its missions during the outage.

The many benefits of this system include instantaneous, base-wide, quality backup power for any duration and the subsequent avoidance of the extensive time and effort associated with mandatory maintenance checks that would have been required after an outage, a reduction in the number of building-level generators, and improved quality of life for all aboard the installation. As of August

2018, the microgrid has prevented more than 60 surges, preventing and mitigating impacts that could have degraded the readiness of both the air station and the surrounding community.

Marine Corps Recruit Depot (MCRD) Parris Island, SC: MCRD Parris Island is planning to install a variety of new energy systems to help reduce its dependence on commercial grid power and diversify its energy sources, increasing energy security and resilience. MCRD Parris Island entered into a $91.1M ESPC with an energy service company (ESCO) that bundles long-term payback resilience measures with short-term payback efficiency upgrades. The project is planned to be completed in spring of 2019 and will include the installation of a 3.5 MW cogeneration plant, 3.5 MW of backup steam generators, and 5.7 MW of solar energy. To save and store the energy generated by the solar panels, a 4 MW/8MW battery energy storage system that can monitor peak loads and discharge to the base grid is also included.

These energy technologies are integrated into a new microgrid control system capable of fast load-shedding, allowing redistribution of power across the grid to where it is needed most. The project will provide the ability to "island" from the commercial grid, provide full back-up power and steam requirements to the base, and will upgrade outdated utility infrastructure with no up-front capital cost. The combination of these distributed energy resources will enable the MCRD Parris Island training mission to continue through or quickly recover from future commercial energy disruptions.

Naval Submarine Base New London: The DoN executed an EUL of 1 acre of land to Connecticut Municipal Electric Energy Cooperative (CMEEC) to develop a 7.4 MW fuel cell using new technologies to improve the installation power quality and energy resilience. During commercial grid outages, the power from the fuel cell will be used to solely support the installation. Connecticut's governor recently approved a $5 million grant to CMEEC from the State Department of Energy and Environmental Protection to design and construct a microgrid that will provide full resilience of the critical power requirements on the installation's waterfront. As an in-kind consideration, the installation will receive physical and legal access to the fuel cells through the microgrid. This project benefits from $40 million of physical assets and $5 million in financial incentives available only to non-DoD activities by using $1 million of underutilized DoN land and an initial capital investment of approximately $1 million.

Naval Station Newport: Leveraging an EUL, the DoN leased 134 acres of contaminated, undevelopable land at Naval Station Newport for the development of a 21MW solar photovoltaic facility. The installation will receive in-kind consideration in the form of a 7.9MW combined heat and power (CHP) plant for on-site resilience and will save $52 million over the lease term. The EUL allows the DoN to leverage unusable land to gain a CHP plant and enhance energy resilience at the installation.

Pacific Missile Range Facility (PMRF) Kauai: The DoN partnered with Kauai Island Utility Cooperative (KIUC) to construct a 19.3MW solar facility and a 70MWh battery energy storage system at PMRF. The DoN used high-speed switching technology to provide an improved

solution for energy resilience that integrates batteries and solar photovoltaic arrays into the grid. The distributed energy resources support local base and regional grid stability by shifting the PMRF peak load demand to the new distributed energy resources and energy storage infrastructure. PMRF will receive in-kind consideration for the value of the land in the form of a direct express feeder to connect the installation to the new generation asset and microgrid capabilities, enabling island mode operations in the event of an outage.

Navy Region Europe, Africa, Southwest Asia and Navy Region Far East ESPC: The DoN partnered with Siemens Government Technologies to integrate the needs of multiple disparate locations and develop regional savings to improve infrastructure across regional requirements. The contract includes implementing renewable, efficient, and resilient energy improvements, such as boiler plant upgrades, building automation systems, energy management control systems, lighting improvements, renewable energy systems, and water and sewer conservation systems, at three overseas installations. The initial investment was valued at approximately $69 million and guarantees $173 million in cost-savings over the 20-year performance period.

Utility Outages

The Navy and Marine Corps continued to improve reporting and tracking of utility (electric, natural gas, district steam, water, and wastewater) outages in FY 2018 and continual analyses of this data year over year will help systematically inform future investment decisions. The Navy reported 161 utility outages in FY 2018 lasting eight hours or longer. Of the total number of outages, 61 were due to an act of nature and 100 to equipment failure. All reported outage events were disruptions to electricity. The USMC reported 27 utility outages in FY 2018 lasting eight hours or longer. Of the total number of outages, 16 were due to acts of nature and 11 to planned maintenance. The majority of reported outage events (24) were disruptions to electricity.

Air Force

Energy resilience, especially in context of a longer-term, regional electrical grid outage, continues to be a focal point for the Air Force. DoD and Air Force guidance provides a codified energy resilience definition as "the ability to prepare for and recover from energy disruptions that impact mission assurance on military installations." The Air Force contextualizes resilience under the term "energy assurance." The guiding tenant for strategic agility in Air Force installation energy programs and projects is "mission assurance through energy assurance." Inherent in energy assurance is reliability and resilience. While Air Force installations are encouraged to be innovative in their approach to energy assurance, the OEA continues to deliberately assess and initiate targeted opportunities to enhance energy and water resilience. To that end, OEA awarded a contract to develop six IEPs, which will help baseline the requirements for subsequent contracted efforts to meet the OSD policy memo issued in May 2018. IEPs will focus installation resilience requirements to the most advantageous technology and funding execution path. While this includes leveraging technical resources (such as partnering with the Air Force Research Lab and

Department of Energy Labs to plan, model, and validate resilience projects), installations are part of wider supporting communities. As opportunities arise, bases and local communities are forming partnering arrangements by which shared resilience goals can be realized.

Air Force installations are given tools to help implement emergency management exercises that include outage scenarios lasting longer than the typical three to five day outage to assess impacts and identify mitigation and remediation strategies for assuring mission readiness. In many cases, the exercises include off base partners, such as the municipal and county emergency services and utility providers. Lessons learned from Air Force staff and installation participation in North American Electric Reliability Corporation's GridEx IV, other outage exercises, and real world events continue to shape the Air Force way forward.

Fundamentally, energy assurance means having power where and when it is needed. Inherent in energy assurance are reliability and availability metrics for installations energy systems. A recently revised Air Force Manual 32-1061 allows more coherent reporting and analysis of energy system performance. Current reporting only provides quantity and duration of outage incidents based on commodity type, location, and cause. Adopting commercial methods should yield more pertinent system reliability and availability data for internal and external comparisons. In the future the Air Force is considering adoption of commercial industry standards.

Notable Air Force Initiatives

The Air Force now has over 140 energy resilience initiatives in development. The following are some examples of Air Force-led initiatives:

1) Joint Base McGuire-Dix-Lakehurst (JBMDL), NJ
   Phase 2 of the JBMDL Energy Resilience Plan (ERP) project was awarded. Negotiations continue with NJ Natural Gas to run their proposed Southern Reliability Link through JBMDL. This new gas supply line will enhance gas reliability to their service area, which includes the Lakehurst area of JBMDL. Easement income, approaching $500,000, will help fund resilience efforts. The multi-year upgrade programs of the McGuire and Lakehurst area electrical distribution systems are nearing completion, with emphasis being placed on the Lakehurst system. Additionally, JBMDL continues to encourage Jersey Central Power & Light to maintain and upgrade the privatized electrical distribution system on the Dix area.

2) RAF Lakenheath (RAFL), UK
   The new F-35 12.5 MW power feed substation is in construction and will provide a redundant power source to the installation. The current primary electrical source will continue to be a part of the RAFL portfolio. A third and separate power source, which is still in the design stage, will bring dedicated renewable solar energy from a local solar farm and connecting directly to the RAFL power network.

3) Schriever AFB, CO

Schriever developed a two phase plan to optimize and provide resilience to the operations of the Central Utilities Plant (CUP). Both phases provide one 8 MW Microgrid project with redundancy. Preliminary design efforts are underway to upgrade the CUP Energy Management Control System, microgrid (phase one and two), the cooling system, and adding more efficient controls for a projected savings of over 52,000 Million British Thermal Units (MMBtus) annually. The FY 2018 ERCIP to replace generators is under design.

4) Joint Base San Antonio (JBSA), TX
The Air Force in conjunction with the Defense Logistics Agency-Energy awarded an ESPC to Ameresco, Inc. on 10 September 2018. This opportunity includes work in all areas of JBSA including Lackland, Fort Sam Houston, Randolph, Kelly, Camp Bullis and Medina Annex. This $142.7 million task order leverages $2.7 million of FSRM up-front direct investment. Under the terms of this task order, approximately 900 buildings totaling 14.7 million square feet will receive energy conservation upgrades that increase energy efficiency, reliability, and resilience. This project installs 20 megawatts of renewable energy systems including CHP and solar PV all inside the fence line, and enhances energy security via microgrid control systems integrating 20 megawatts of on-site generation, backup generation assets, and battery energy storage (8 MW-hours) to keep the bases operational until start-up of backup generators. The ESPC also upgrades HVAC energy management control systems, adds HVAC thermal energy storage (TES), installs new lighting & controls, improves building envelopes and implements water conservation measures. The projected annual energy savings are 356,841 MMBtu/year providing 24 percent reduction of energy usage for the in-scope facilities.

Utility Outages

In FY 2018, Air Force installations reported 239 outage incidents to their basic energy commodities (i.e., electricity, water, natural gas, and waste water) with a duration greater than or equal to 8 hours, a 33 percent decrease from FY 2017. However, reporting only those outages masks the larger number of under-reported sustained outages (i.e., between 5 minutes and 8 hours). Electrical incidents comprised 88 percent of the outages compared to water at 9 percent, and natural gas at 3 percent. No waste water outage incidents were reported. The highest outage frequency occurred among four MAJCOMs (AFGSC, ACC, PACAF, and AETC). However from a financial perspective, AFMC reported the most substantial costs at about $4.75 million ($338,708/electrical incident). Overall, the Air Force had a financial impact of $5.36 million ($22,213/all incidents) or, when factoring out AFMC electrical outages, $614,710 ($2,732/all incidents)

The Air Force has managed to reduce the frequency of outage incidents year over year and managed their financial impacts. Continued execution of planned maintenance activities should further decrease outage frequencies. Additionally, new tools such as the ERA Tool and AFCEC's Utility System Outage Report Tracker (USORT) are coming online to help installations evaluate,

baseline, and monitor their utility systems in the near future. For example, ERA will aid Air Force installations in planning their future resilience efforts by analyzing multiple energy project scenarios and providing the most optimal solution based on the installation's assets. Furthermore, USORT will help Air Force installations track and report near-realtime outage details such as start/end times, causation, sourcing (i.e., on- or off-base), etc., on CE DASH as they occur, thereby streamlining outage reporting.

4. Cybersecurity and Facility Related Control Systems (FRCS)

The NDS specifically highlighted the threats faced by the Department's Control Systems (CS), particularly those supporting Defense Critical Infrastructure (DCI). CS in DoD are subject to a growing range of cyber threats as these systems have increasingly become more automated and connected. The attack surface for would be attackers has increased exponentially as result of the integration of network-based building management systems, internet of things (IoT) devices, as well as the connection of legacy control systems such as SCADA into these networks.

Cybersecurity threats to FRCS are not only a DoD issue. Attacks such as "Stuxnet," "Black Energy," and "Crashoverride" were specifically designed to attack the CS of both commercial and civil owned infrastructure enterprises around the world. As multiple industry and government advisories have publicized, CS are an active target for cyberattacks such as ransomware, Distributed Denial of Service (DDoS) attacks, and malware tailored to CS, which could degrade or deny operations. The "Black Energy" campaign and "HAVEX" malware attack were specifically designed to exploit control systems at the device level; "Flame" and "Duqu" malware exploits physically destroyed control systems front-end IT servers and workstations; "TRITON" was designed to specifically target the industrial safety systems (SIS), or fail safe control systems, used predominantly in the oil and gas industry; and the Ukraine electric grid attack demonstrated the capability to cut power to mission critical facilities.

Unfortunately, despite repeated warnings and highly-publicized accounts regarding attacks, many system operators and owners do not believe their systems are under significant threat. As a result, throughout the entire national power infrastructure enterprise, many utilities and associated industries have not focused enough resources and attention on eliminating vulnerabilities that stem from gaps in user knowledge, ineffective application of cybersecurity frameworks, poor monitoring of systems for exploitation, and limited, if any, recovery programs. Billions of dollars have been spent over the last decade to secure the broader networks and devices that generate, edit, transmit and store protected health information (PHI) and personally identifiable information (PII) in areas such as the financial markets and healthcare industry. While these efforts have had limited positive impact on reducing threats, particularly with regards to creating frameworks and technologies that can be leveraged to provide baseline cybersecurity, they still demonstrate progress. The same cannot be said for CS in energy infrastructure.

FRCS supporting the Department's energy infrastructure are essential to performing warfighting capabilities, executing critical missions, and projecting power. DoD FRCS and other CS are actively threatened by adversaries and are highly vulnerable to cybersecurity attacks and failures. The risks to CS increase as more CS devices are connected to networks without appropriate cybersecurity protections.

The Department has begun to take steps within the CS environment to reduce vulnerabilities and ensure greater security. The NDS explicitly highlights the need for secure and resilient CS to provide for warfighting capabilities, execute critical missions, maintain operational readiness, and

project power. In FY 2018 the Joint Chiefs of Staff (JCS) and ODASD(DC&MA) published updated DoD Joint Mission Assurance Assessment (JMAA) Benchmarks to provide mission assurance stakeholders and mission owners a framework for assessing and cataloging risks to infrastructure, including cyber infrastructure, that impact DCI.

ASD(EI&E) released updated guidance in April 2018 that outlines a process for owners and operators of FRCS connected to the DoD Information Network (DoDIN) to account for operational resilience and cybersecurity defense posture. This FRCS Cybersecurity Plans Guidance memorandum outlines a framework and provides a template for FRCS owner/operators to develop a FRCS Cybersecurity Plan to address CS connected to the DoDIN, as well as systems that are internet-facing or stand alone. The intent of these plans is to assist the DoD Components with building and recording CS inventories and to ensure a standard format for review/oversight across the Department. The DoD Components are actively implementing these plans with the requirement to complete them in FY 2019 for FRCS supporting Defense Critical Assets (DCA), Tier 1 Task Critical Assets (TCAs), as well as all FRCS that are connected to the DoDIN, are internet-facing and/or stand-alone, and which require Authorization to Operate (ATO).

In July 2018 the Deputy Secretary of Defense (DSD) published a memorandum titled "Enhancing Cybersecurity Risk Management for Control Systems Supporting DoD-Owned Defense Critical Infrastructure" that tasks DoD with implementing standardized best practices, improving CS information sharing, advancing cyber assessment capabilities, maintaining CS training, and establishing a reporting requirement to ensure CS cybersecurity accountability. The memorandum also established the role of Principal Cyber Advisor to advise the Secretary of Defense on efforts to enhance the security of DoD CS. Many of the memorandum's requirements are based in existing DoD policy and statutory requirements and the memorandum provides DoD Components with clear expectations for timelines associated with adherence to these requirements. For example, the DoD Components were tasked with applying the National Institute of Standards and Technology Cybersecurity Framework (NIST CSF) and related guidance consistent with DoDI 8510.01 beginning no later than July 30, 2018 and USCYBERCOM was tasked with disseminating threat, vulnerability, and mitigation information to all CS stakeholder beginning no later than September 30, 2018. These are just two examples of the thirteen topline requirements laid out in the DSD memorandum.

In December 2018 the DoD CIO published a memorandum titled "Control Systems Cybersecurity" stating that mission assurance is dependent on the robust cybersecurity of the underlying control systems that support all operations. It is imperative the Department move with deliberate speed to secure its critical control systems through a comprehensive risk management approach to inventory systems, assess vulnerabilities, develop mitigations, and remediate risk. The forthcoming updates to the DoD cybersecurity program, in DoD Instructions 8500.01, 8510.01, and 8530.01 will include the responsibilities outlined in this memorandum and address policy gaps in control systems cybersecurity across the DoD enterprise.

Although not specific to FRCS, in FY 2018 DoD also published the *2018 DoD Cyber Strategy*. Per this strategy, DoD's objectives in cyberspace include:

1. Ensuring the Joint Force can achieve its missions in a contested cyberspace environment;
2. Strengthening the Joint Force by conducting cyberspace operations that enhance U.S. military advantages;
3. Defending U.S. critical infrastructure from malicious cyber activity that alone, or as part of a campaign, could cause a significant cyber incident;
4. Securing DoD information and systems against malicious cyber activity, including DoD information on non-DoD-owned networks; and
5. Expanding DoD cyber cooperation with interagency, industry, and international partners.

As it relates to the cybersecurity of FRCS and the broader DoD CS environment, this strategy aims to:

1. Increase the resilience of U.S. critical infrastructure;
2. Incorporate cyber awareness into DoD institutional culture; and
3. Sustain a ready cyber workforce.

The Department still has substantial challenges ahead of it to address the growing threats to DoD and partner FRCS, but the policies and actions put into place in FY 2018 have created a credible foundation and more apparent path forward for DoD to implement sound cybersecurity processes and technologies to protect its FRCS.

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5. DoD's Progress to Achieve Statutory Energy Management Requirements

Installation Energy Demand Overview

This section describes the scope of the Department's installation energy demand in terms of cost and consumption. DoD is the largest single energy-consuming entity in the United States, both within the Federal Government and as compared to any single private-sector entity. DoD operational and installation energy consumption represents approximately 80 percent of total Federal energy consumption, more than sixteen times the total energy consumption of the next closest Federal agency (the United States Postal Service).[3]

In FY 2018, DoD spent approximately $3.49 billion on installation energy, which included $3.40 billion to power, heat, and cool buildings; and $91 million to supply fuel to the fleet of NTVs. DoD consumed 210,180 billion Btus (BBtus) of installation energy; 202,832 BBtus in buildings (stationary combustion) and 7,348 BBtus in NTV fleet (mobile combustion). The Army was the largest consumer of installation energy, followed by the Air Force, and DoN. Electricity and natural gas accounted for 84 percent of DoD installation energy consumption. The remaining portion of installation energy consumption included fuel oil, coal, steam, and liquefied petroleum gas (LPG). DoD's installation energy consumption mix mirrors that of the U.S. commercial sector, where natural gas and electricity dominate the supply mix.

Energy Consumption

DoD captures installation energy consumption to help promote energy efficiency measures. Figure 3 illustrates recent historical trends in installation energy consumption by DoD Components across all buildings.[4] Installation energy consumption has increased slightly in recent years due to a shift in focus from energy efficiency investments to energy resilience investments, which do not always yield energy savings.

[3] FEMP, Comprehensive Annual Energy Data and Sustainability Performance [online source] (Washington, D.C. April 26, 2018, accessed April 3, 2019), available from http://ctsedwweb.ee.doe.gov/Annual/Report/TotalSiteDeliveredEnergyUseInAllEndUseSectorsByFederalAgencyBillionBtu.aspx

[4] Energy consumption does not include consumption from NTVs. The Department reported meeting the petroleum reduction and alternative fuel goals in its FY 2015 Annual Energy Management Report to the congressional committees. It continues to participate in efficiently reporting and providing petroleum and alternative fuel vehicle data to Congress and the Office of Management through its Federal Fleet Report, located at the following: https://www.gsa.gov/policy-regulations/policy/vehicle-management-policy/federal-fleet-report. It also reports and publishes progress to these goals through OMB, and the continued progress to meet these goals can be viewed at https://www.sustainability.gov/.

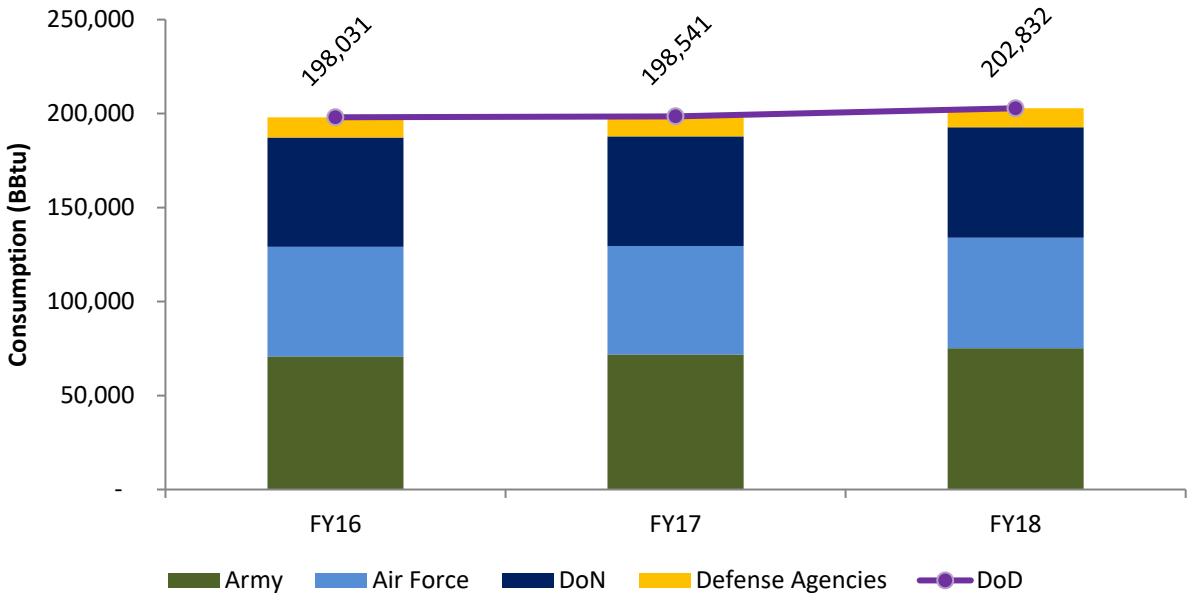

Figure 3: Installation Energy Consumption by Military Service (Excluding NTV Consumption)

Renewable Energy

As DoD pursues renewable energy to advance its energy resilience, it also seeks to comply with legal requirements to increase its renewable energy supply. The Department is subject to two renewable energy goals: title 10 U.S.C. § 2911(g) and Section 203 of the Energy Policy Act (EPAct) 2005 (42 U.S.C. § 15852(a)).

Title 10 U.S.C. § 2911(g) established a goal for DoD to produce or procure not less than 15 percent by FY 2018[5] and 25 percent of the total quantity of facility energy it consumes within its facilities by FY 2025 and each FY thereafter from renewable energy sources. DoD progress toward the title 10 U.S.C. § 2911(g) renewable energy goal in FY 2018 was 15.76 percent.

The EPAct 2005 goal considers total renewable electricity consumption as a percentage of total facility electricity consumption, with the goal of 7.5 percent by 2013 and every FY thereafter. Renewable electricity consumption subject to these requirements was 5.9 percent of DoD total electricity consumption, falling short of the 7.5 percent goal. Figure 5 illustrates DoD progress towards this goal since FY 2007.

[5] This interim renewable energy goal was established as part of the Energy Performance Master Plan in the FY 2011 AEMRR. See Appendix C for details on DoD energy goals.

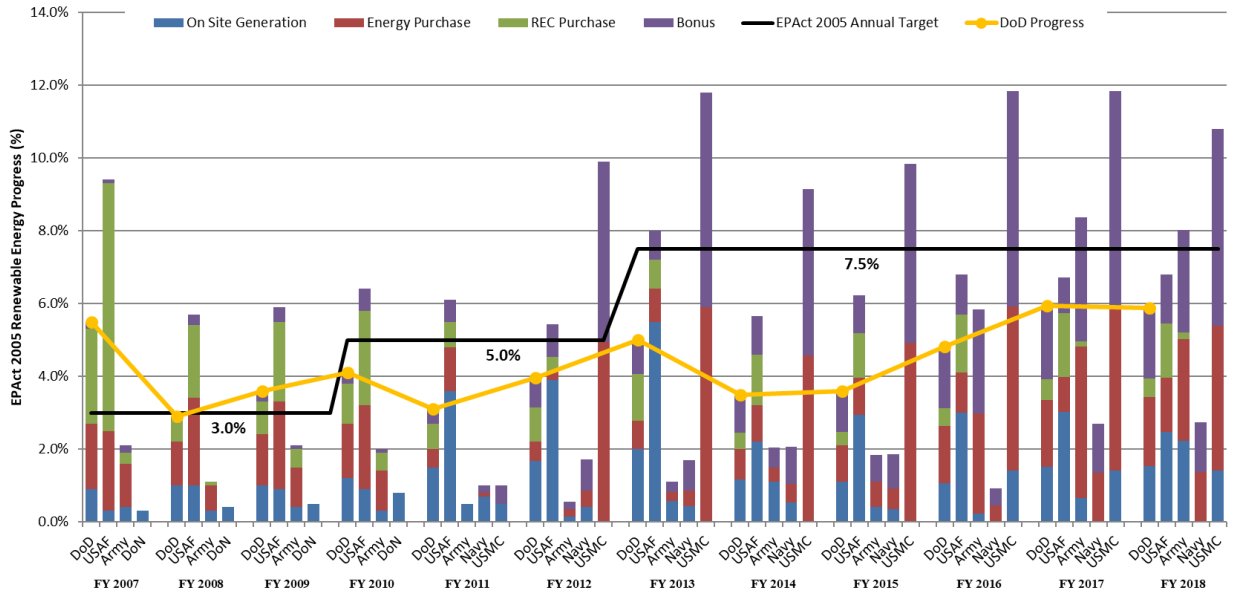

Figure 4: EPAct 2005 Renewable Energy Goal Attainment

The Department uses various authorities to increase the supply of distributed (on-site) and renewable energy sources on its installations. DoD uses both appropriated funds and non-Governmental (often referred to as 'third-party' or 'alternative') financing to pursue renewable energy projects. DoD partners with private entities to enable the development of large-scale renewable (or other distributed) energy projects and relies on congressional appropriations to fund cost-effective, small-scale distributed generation projects. The main authorities used to pursue third-party financing of renewable energy projects are Utility Service Contracts (USCs), PPAs, and outgrants. Sections 2922(a) and 2667 of title 10 U.S.C. are not limited to renewable energy sources and can also be used for non-renewable energy sources such as natural gas and other fuel types. Section 2410(q) of title 10 U.S.C. is limited to renewable energy sources.

Army

The Army registered a total delivered energy consumption of 75.1 trillion Btus, costing approximately $1.15 billion. Compared to FY 2017, the Army used approximately 4.6 percent more energy and paid an additional $65.1 million (6.0 percent). The Army identifies and implements cost-effective reduction measures that are targeted at contributing to mission readiness. These measures reduce reliance on commercial energy supplies and improve overall energy security of Army installations. The Army diversified its energy sources by installing an additional 82.6 MW of renewable energy capacity in FY 2018, increasing the total renewable energy capacity to 517.6 MW. The Army will continue to maximize readiness and mission assurance in future years by building on these successes. In particular, the Army will conduct a prioritized rollout of the IEWP to installations through FY 2021.

<u>Funding</u>

The Army leverages a variety of funding mechanisms to better enhance the energy security of its installations. In FY 2018, the Army awarded six ESPC task orders and modifications with an investment value of $99.8 million and three UESC projects worth $14.1 million, for a total of $113.9 million. Accumulated savings are used to repay the third-party investments over the life of the contracts. The combined Army ESPC and UESC investment since inception of the programs is $2.9 billion.

Programs

ERCIP

The Army continues to focus ERCIP projects on energy resilience requirements for critical missions. Because these types of projects are becoming increasingly complex, the Army recognizes the need for a more structured planning and programming process. In FY 2018, the Army piloted a planning charrette process that brings together all stakeholders to comprehensively review and establish programming requirements prior to final submission of FY 2021 ERCIP projects. The Army will employ this new process for all energy and water resilience projects.

UP

The Army uses UP to achieve significant energy efficiency and modernization upgrades to utility infrastructure. UP is a cost-effective plan for addressing deferred maintenance backlogs. UP leverages private sector financing and expertise, reduces risks, and transfers liability. Upgrading infrastructure and operations to industry standards improves energy and water resilience and reliability for Army missions. As of October 2018, 151 utility systems in the U.S. have been privatized. Recapitalization through UP brings an average net reduction of 35 percent in gas usage. In addition, when compared to the average use by Army-owned water systems, privatized water systems use 16 percent less water on average.

Demand response (DR)

The Army released guidance and a handbook encouraging installation participation in DR programs with their electric utility providers or through the DLA's agreement with curtailment service providers. By shifting electric use during peak hours, installations can lower their utility costs and receive incentives. The Army evaluated market opportunities, identified specific strategies, and conducted site-specific assessments to determine whether DR is a viable opportunity to reduce and manage utility costs. In August 2018, the Army conducted demand response training for Energy Managers in support of Army Energy and Water Reporting System (AEWRS) data improvement to track participation and determine its financial impact on utility costs. In FY 2018, there were 16 Army installations participating in DR programs with financial benefits of $3.7 million credited toward the utility bills of the participating sites. DR benefits reduced total Army electric costs in FY 2018 by 0.5 percent.

Army Metering Program

The Army's 2014 Utilities Meter Policy required installation of advanced electric, natural gas, water, and steam meters to capture at a minimum 60 percent of that commodity's use with a goal

of 85 percent and automatically report to the Army's Meter Data Management System (MDMS) by 2020. While the Army continues to install electric meters, connectivity in reporting consumption to MDMS remains a challenge. In FY 2018, electric meters were installed in more than 34.2 percent of the total number of buildings identified as appropriate for metering. However, only 17.5 percent of electricity consumption is currently reporting to the MDMS due to connectivity and sustainment issues. The Army is implementing a revised execution plan to improve availability of data for energy managers.

Renewable Energy

Renewable energy is an essential component of the Army's energy security and resilience plan. Assured access to reliable supplies of energy and the ability to protect and deliver sufficient energy to meet operational requirements is an explicit goal of Directive 2017-07. Onsite energy generation is a means to diversifying supply at installations and reducing reliance on commercial energy grids. The Army pursues onsite renewable energy development for assuring access where it is the most life cycle cost effective solution. Onsite renewable generation, when coupled with energy storage, can provide Army installations with long-term energy resilience.

In FY 2018, the Army increased its renewable energy capacity for the fourth year in a row. The Army added 82.6 MW of renewable energy capacity in FY 2018 through 39 new projects for total 517.6 MW. The total percentage of renewable electric energy eligible toward the EPAct 2005 goal decreased from 8.4 percent in FY 2017 to 8.0 percent in FY 2018. Due to the rescission of EO 13693, ground source heat pumps (GSHP) are now classified as renewable energy non-electric.

The Army continues to employ a comprehensive approach to renewable energy, focusing on supporting installation mission requirements. The Army's cost-effective investments include small-scale projects on rooftops and in parking areas, larger projects funded through ERCIP or financed through ESPCs and UESCs, and utility-scale projects leveraging private financing through available Federal and DOD authorities. In FY 2018, the Army added 12.8 MW of renewable electricity capacity through a variety of programs that leverage private or third-party financing, such as PPAs, ESPC/UESC, or GSA area-wide utility contracts. The Army's Office of Energy Initiatives (OEI) facilitates utility-scale projects by leveraging private equity. OEI continues to look for private financing opportunities, focusing on the development of generation projects that include energy storage and controls allowing continuing power support to installations requirements in the event of an extended utility outage.

The Army leveraged third-party financing to install 4.7 MW of renewable electricity generation through the Residential Communities Initiative as well as ERCIP and MILCON funds to add 2.0 MW of additional renewable electric generation. In FY 2019, the Army will continue its approach to investing in renewable energy where it supports installation mission readiness and makes economic sense using all available funding mechanisms.

DoN

Partnerships

The DoN continued to partner with industry to provide energy consumption savings and facility improvements by leveraging third-party financing to preserve appropriated funds for use in support of higher priority warfighting requirements for which alternative financing is not viable. In FY 2018, the DoN executed multiple long-term third-party financed contracts valued at $225 million for infrastructure modernization including:

- A Navy Region Europe-Africa-Southwest Asia $69 million ESPC for energy improvements at Naval Air Station Sigonella, Naval Station Rota, and Naval Support Activity Naples for improved HVAC, water, and lighting systems.
- A Navy Region Far East $77 million ESPC for improvements to lighting, water, and sewer systems, and boiler plant upgrades at Naval Air Station Atsugi, Naval Station Yokosuka, and Naval Station Sasebo.
- A UESC between Naval Submarine Base New London and Groton Utilities to provide natural gas to H-Barracks for heating needs. The cost of repairing the steam line that fed these barracks had put permanent repairs to these buildings heating system out of reach for many years. By using third-party financing, the installation was able to use projected savings to fund an alternative repair. The solution decentralized steam piping and provided local heat using natural gas fired boilers. This effort saves over $200,000 per year, an additional $6 million in avoided operations and maintenance expenses.

These contracts provide major infrastructure upgrades to the Navy and are financed by guaranteed energy savings; infrastructure upgrades the Navy is unlikely to have obtained through traditional project funding.

USMC steam decentralization projects at Camp Lejeune and MCRD San Diego have resulted in significant energy efficiency savings at those installations. The $30 million MCRD San Diego Project removed approximately 40 buildings from the steam distribution network through the installation of new energy efficient space and domestic water-heating systems and infrastructure. The $150 million Camp Lejeune steam decentralization project used multiple funding streams to successfully replace five inefficient, outdated steam utility systems with 641 small high-efficiency natural gas hot water condensing boilers.

In addition to infrastructure projects, strong energy conservation messaging continue to be reinforced locally. Many Navy installations continued to successfully reduce energy consumption by consistently emphasizing a culture of conservation with support through visible leadership presence at the regional and base levels. Incentive programs that encourage individual efforts for building and workplace energy reduction added to the impact of energy investments. Navy Region Mid-Atlantic has a “Battle ‘E’ for Energy” program; in Europe installations compete in the “Fuel for the Fleet” challenge, Naval Station Norfolk has an “Energy Reduction Derby” and Navy

Region Northwest has a tenant energy efficiency competition program where winners are recognized throughout the year by the Installation Commanding Officer. Culture change remains an important aspect of the DoN's approach to energy management while efforts to identify, fund or finance, and execute facility energy projects to lower energy demand and increase efficiency are pursued in parallel.

Renewable Energy

In FY 2018, the Navy did not achieve the renewable electricity consumption goal of 7.5 percent established in title 42 U.S.C. § 15852(a), consuming only 2.73 percent of installation electricity from renewable sources. The USMC continues to exceed the 7.5 percent target, consuming 10.79 percent of electricity from renewable sources in FY 2018. This marks a marginal increase from 10.5 percent achieved in FY 2017.

The DoN continued to make progress against the renewable energy goal established in title 10 U.S.C. § 2911(g). In FY 2018, the Navy produced or procured 29.42 percent of renewable energy relative to electricity consumed. This marks the first year the Navy has achieved the 25 percent by FY 2025 goal. The USMC produced or procured 15.73 percent of renewable energy relative to electricity consumed, an increase from 12.26 percent in FY 2017. Navy and USMC will continue to produce and procure energy from renewable sources so long as such actions improve installation energy resilience and mission readiness.

Installation Energy Managers (IEMs)

IEMs play a critical role in helping Navy shore installations effectively and efficiently manage energy resources. In FY 2018 DoN reviewed the IEM's roles and responsibilities; knowledge, skills and abilities, and training requirements to adequately perform energy management duties. As a result, the first Energy Manager Community Management Plan (CMP) was signed out to ensure all energy managers are aligned to DoN expectations under the Energy Security Framework and have a career path that promotes professionalism, education and training. Additionally, DoN conducts four annual management assist visits (MAVs) to ensure minimum expectations are being met, ensure vacancies are being filled with energy professionals and to gain a better understanding of challenges throughout all regions and installations. Due to the growth in complexity of the energy management field and the imposition of new energy security requirements spanning various technical energy engineering disciplines, new hires into the installation energy management role will be required to have more general knowledge and considerable relevant professional experience in the areas of planning, project and program management, energy reliability, energy resilience, energy efficiency, cybersecurity, and others subjects that intertwine with energy management.

IEPs

Since August 2012, DoN has developed IEPs through the Shore Energy Implementation Portfolio (SEIP) per established guidance in OPNAV 4100.5E (Shore Energy Management). These plans enabled DoN to ensure compliance across all energy objectives. In FY 2018 DoN

initiated the development of an IEP template to facilitate the integration of cyber and other energy requirements. The template was rolled out during the 2018 Energy Exchange and ensures alignment with installation development plans (IDP). This effort highlights the importance of energy managers working on the right focus areas across all business and support lines to include installation planners, building operations and maintenance, utility personnel, cyber security subject matter experts, and others. IEP briefs for the first 15 installations will be briefed to CNIC, NAVFAC, and DoN in the fourth quarter of FY 2019.

UP

The Navy has revitalized its UP program pursuing a handful of pilot locations to test a new process for pursuing or not pursuing privatization based on business case analysis of best value. The goal of the pilots is to support increased reliability, increased resilience, leverage industry expertise, increase efficiency with improved infrastructure, and minimize system lifetime total ownership costs.

Advancing Navy Commodity Cost Reductions (ANCCR):

The Navy has developed a new utility cost analysis program called ANCCR that has developed a strategy to reduce utility costs. The program was created to reduce projected utility commodity costs, identify market and utility revenue opportunities, and optimize enterprise-wide business processes.

Air Force

In FY 2018, energy consumption was 56,080 BBtu, a 1,075 BBtu increase from 55,005 BBtu in FY 2017. Additionally, 67 of 184 installations saw a decrease in energy consumption and 80 installations saw a decrease in costs. Harsh winter conditions during the winter of 2018 contributed to energy consumption increases, especially in the northeastern U.S.

A review of information received from Air Force bases reveal a variety of strategies used to reduce energy consumption. Most often mentioned were continued use of Facility Sustainment, Restoration & Modernization (FSRM), and ERCIP funds along with ESPC and UESC third-party financing. In particular, funds were primarily used to convert to HEL and replace inefficient HVAC systems with newer more efficient systems. Various awareness programs continue to educate and motivate personnel across installations to contribute to energy reductions.

A review of information received from installations where consumption increased indicated more extreme summer and winter conditions. In particular, many bases located in the northeast U.S. region reported harsher winter conditions than previous years. New mission construction or increased mission operations tempo were also contributing factors in several instances. The national trend of low energy costs continues to affect the ability to produce effective projects justified on life-cycle costs.

Renewable Energy

In FY 2018, 6.8 percent of the electrical energy used by the Air Force was produced from renewable sources. This represents an increase of 7,073 MWh from the 6.7 percent in FY 2017, and is below the EPAct 2005 goal of 7.5 percent. In addition, the Air Force performance toward the title 10 U.S.C. § 2911(g) goal was 6.9 percent for both electric and non-electric energy used in FY 2018.

Major operational renewable energy projects in FY 2018 included 14.2 MW and 19 MW solar PV arrays using a PPA at Nellis AFB, NV; a 28.2 MW solar PV array at Vandenberg AFB, CA using PPA mechanism; a 16.4 MW PPA solar PV array at Davis Monthan AFB, AZ using an indefinite term FAR Part 41 contract mechanism; a 6 MW PPA solar PV array at US Air Force Academy, CO; and a 3 MW PPA solar PV array at Edwards AFB, CA. Larger government funded (ERCIP) operational renewable projects include a 3.4 MW wind project at Cape Cod AFS, MA and a 1 MW solar PV array project at Buckley AFB, CO. Other third-party funded operational renewable energy projects include a 2.3 MW landfill gas generation plant at Hill AFB, UT; a 7 MW landfill gas generation plant at Joint Base Eielson-Richardson (JBER)-Richardson, AK; and EUL projects of a 10 MW solar PV array at Luke AFB, AZ; a 30 MW solar PV array at Eglin AFB, FL; and a 20 MW solar PV array at AF Plant 42, Palmdale, CA.

GSHP projects within the Air Force have a total 11,741 tons of operating capacity, which is equivalent to approximately 6,493 MWh of resilient renewable energy. GSHP projects were executed using various funding sources including ESPC, UESC, and ERCIP.

Mountain Home AFB, ID will continue to develop its geothermal resource by initiating an Environmental Assessment and establishing power requirements for mission critical facilities in support of a resilient baseline geothermal power plant, and will be the pilot for other Air Force geothermal initiatives.

The Air Force has long recognized the significant role that the MILCON program plays in achieving Federal energy mandates. Despite FY 2018 fiscal constraints, the Air Force is incorporating renewable energy projects in MILCON building designs.

Renewable Energy Plans

The Air Force renewable energy use was 6.8 percent of its total electrical energy consumption through a mixture of renewable on-base projects and purchased commercial renewable supply. The Air Force renewable energy plan focuses on the development of resilient, cost effective on-base electric and non-electric energy projects that support the mission. The renewable market will continue to be constrained for the foreseeable future by prevailing utility commodity costs and the availability of economic incentives, such as federal, state, and local tax incentives.

In FY 2019, AFCEC plans to execute EULs for a 13 MW solar PV project at Joint Base McGuire-Dix-Lakehurst (JBMDL) - Lakehurst, NJ and a 17 MW solar PV project at JBMDL - Dix, NJ.

Direct Air Force renewable project funding through ERCIP or other Air Force capital sources is rarely cost-effective when compared to commercial utility rates. This is primarily because the Air Force cannot benefit from tax rebates and incentives. As a result, renewable energy and resilience capabilities have started to be pursued through third party financed arrangements such as ESPCs and UESCs.

The Air Force has moved toward purchasing renewable power from third-party financed projects developed on bases as the primary strategy to reduce cost and improve base resilience. The developer can recoup the construction investment by the firm sale of power and by taking advantage of tax credits. Although the government cannot benefit from these financial mechanisms on Air Force owned property, it does benefit by purchasing lower-cost power and gaining dedicated renewable resilience electric supply on-base.

Under EPAct 2005 regulation, a third-party developed on-base renewable project that sells the RECs will not be considered renewable, and thus not count toward the Air Force renewable energy goals. Also, the bonus credit will be lost for on-base renewable generation. A purchase of a lower-cost replacement REC will reinstate the renewable status of the project, as well as the bonus credit. Therefore, purchasing replacement RECs will be a part of the Air Force strategy to meet the aggressive statutory renewable goals, but depending on the specific situation, RECs may be included with the project. Nevertheless, RECs remain a useful contingency tool in reaching long-term legislative mandated targets.

The Air Force seeks opportunities to incorporate renewable energy and resilience on its installations. Previous studies considered conventional renewable energy opportunities, such as wind, solar, and biomass, but also accounted for passive renewable energy alternatives such as solar walls, solar water heating, and GSHPs. In FY 2018, the Air Force had approximately 355 renewable energy projects on 123 sites, either in operation or under construction. Planned renewable energy projects are actively being pursued.

Defense Agencies

In FY 2018, the Defense Agencies continued to pursue opportunities to reduce installation energy consumption and increase renewable energy consumption. Some highlights of successes are included below:

DeCA

- DeCA has coordinated with Installations when they have been installing renewable systems and some Installations have used DeCA facilities to install their renewable systems.

DFAS

- DFAS Rome and Limestone had a 37.2 percent energy consumption reduction from the baseline. Both sites invested in new boiler, heat pump, and chiller systems over the past 4 years.

NRO

- The NRO continued to implement many energy savings measures in FY 2018. Across the enterprise these measures included data center optimization and updating corridor, cafeteria, and restroom lighting to LED.
- The NRO increased use of advanced metering to improve energy management, aggressively pursued energy conservation improvements that could be made to facilities during refurbishment or recapitalization, conducted outreach programs at sites to encourage energy efficient behaviors, and audited personal appliance use to quantify energy efficient alternatives.

DIA

- DIA continues to find low-cost/high-impact energy reduction improvements and prioritizes initiatives based on mission impact. There has been positive mission impact from completed projects using ERCIP funding.
- Projects such as replacing starters with variable frequency drives (VFDs) and fluorescent lighting with LEDs have reduced energy consumption.
- Central plant optimization has reduced DIA energy consumption by 32 percent while maintaining mission requirements. The investment was paid back in only 3.8 years.

Appendix A - List of Energy Acronyms

Acronym	Definition
AEMRR	Annual Energy Management and Resilience Report
AEWRS	Army Energy and Water Reporting System
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AFIMSC	Air Force Installation and Mission Support Center
AFV	Alternative Fuel Vehicle
ANGB	Air National Guard Base
ARNG	Army National Guard
ASA(IE&E)	Assistant Secretary of the Army for Installations, Energy and Environment
ASD(Sustainment)	Assistant Secretary of Defense for Sustainment
ASD(EI&E)	Assistant Secretary of Defense for Energy, Installations and Environment
ASN(EI&E)	Assistant Secretary of the Navy for Energy, Installations and Environment
ASRA	Army Strategic Readiness Assessment
BBtu	Billion British Thermal Units
BOS	Base Operations Support
Btu	British Thermal Unit
CMS	Critical Mission Sustainment
CNG	Compressed Natural Gas
CNIC	Commander, Navy Installations Command
CNIC N4	Commander, Navy Installations Command Facilities and Environmental Department
CNIC N441	Commander, Navy Installations Command Energy and Utilities Branch
CNO	Office of the Chief of Naval Operations
CO2e	Carbon Dioxide Equivalent
COMMCICOM	Commander Marine Corps Installations Command
CONUS	Contiguous United States
CS	Control Systems
CY	Calendar Year
DASA(IE&E)	Deputy Assistant Secretary of the Army for Installations, Energy, and Environment
DASN(I&F)	Deputy Assistant Secretary of the Navy for Installations & Facilities
DCI	Defense Critical Infrastructure
DC I&L	Deputy Commandant for Installations and Logistics
DCMA	Defense Contract Management Agency
DeCA	Defense Commissary Agency
DEPSECDEF	Deputy Secretary of Defense
DERB	Defense Energy Resilience Bank
DFAS	Defense Finance and Accounting Service
DIA	Defense Intelligence Agency

Acronym	Definition
DLA	Defense Logistics Agency
DoD	Department of Defense
DoDI	Department of Defense Instruction
DOE	Department of Energy
DoN	Department of the Navy
DUSD(I&E)	Deputy Under Secretary of Defense (Installations and Environment)
E85	85 percent ethanol fuel
ECIP	Energy Conservation and Investment Program
EIA	Energy Information Administration
EISA 2007	Energy Independence and Security Act of 2007
EMIG	Energy Mission Integration Group
EO	Executive Order
EPAct 2005	Energy Policy Act of 2005
ERA Tool	Energy Resilience Assessment Tool
ERCIP	Energy Resilience Conservation and Investment Program
ERRE	Energy Resilience Readiness Exercise
ER TTX	Energy Resilience Tabletop Exercise
ES²	Energy Security and Sustainability
ESCO	Energy Service Company
ESPC	Energy Savings Performance Contract
ESTCP	Environmental Security Technology Certification Program
EUL	Enhanced Use Lease
EV	Electric Vehicle
FRCS	Facility-Related Control Systems
FY	Fiscal Year
GGE	Gallons of Gasoline Equivalent
GHG	Greenhouse Gas
GSA	General Services Administration
GSF	Gross Square Foot
GSHP	Ground Source Heat Pump
HQ	Headquarters
HQ USAF	Headquarters Air Force
HVAC	Heating, Ventilation, and Air Conditioning
IC	Intelligence Community
IEP	Installation Energy Plan
IEWP	Army Installation Energy and Water Plan
ILA	Industrial, Landscaping, and Agriculture
IOC	Initial Operational Capability
ISR-MC	Army Installation Status Report – Mission Capacity
IT	Information Technology

Acronym	Definition
JCS	Joint Chiefs of Staff
KW	Kilowatt, 1 thousand Watts
LPG	Liquefied Petroleum Gas
MAJCOMS	Major Commands
MCAGCC	Marine Corps Air Ground Combat Center
MCAS	Marine Corps Air Station
MCICOM	Marine Corps Installations Command
MCICOM GF	Marine Corps Installations Command, Director Facilities
MCICOM GF-1	Marine Corps Installations Command, Energy and Facilities Operations Section
MCRD	Marine Corps Recruit Depot
MDA	Missile Defense Agency
MDMS	Meter Data Management System
MFGI	Mobilization Force Generation Installation
MGal	Million Gallons
MILCON	Military Construction
MIT-LL	Massachusetts Institute of Technology – Lincoln Laboratory
MMBtu	Million British Thermal Units
MR&R	Maintenance, Repair, and Replacement
MSW	Municipal Solid Waste
MW	Megawatt, 1 million Watts
MWh	Megawatt-Hour, 1 million Watt-hours
NAS	Naval Air Station
NAVFAC	Naval Facilities Engineering Command
NDAA	National Defense Authorization Act
NDS	National Defense Strategy
NECPA	National Energy Conservation Policy Act
NGA	National Geospatial Intelligence Agency
NRO	National Reconnaissance Office
NSA	National Security Agency
NSA	Naval Supply Activity
NTV	Non-Tactical Vehicle
OM&T	Operations, Maintenance and Testing
OACSIM	Office of the Assistant Chief of Staff for Installation Management
OASD(Sustainment)	Office of the Assistant Secretary of Defense for Sustainment
OCONUS	Outside Continental United States
ODASD(Energy)	Office of the Deputy Assistant Secretary of Defense for Energy
ODASD(DC&MA)	Office of the Deputy Assistant Secretary of Defense for Defense Continuity and Mission Assurance
OEA	Air Force Office of Energy Assurance
OPNAV-N46	CNO Shore Installation Management Division
OSD	Office of the Secretary of Defense

Acronym	Definition
OT	Operational Technology
PEV	Plug-in Electric Vehicle
PHI	Protected Health Information
PII	Personally Identifiable Information
PIT	Platform Information Technology
PPA	Power Purchase Agreement
PPP	Power Projection Platform
PV	Photovoltaic
REC	Renewable Energy Credit
SAF/IE	Assistant Secretary of the Air Force (Installations, Environment & Energy)
SAF/IEE	Deputy Assistant Secretary of the Air Force Environment, Safety and Infrastructure
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SCADA	Supervisory Control and Data Acquisition
SECDEF	Secretary of Defense
SESC	Senior Energy and Sustainability Council
SIR	Savings to Investment Ratio
SMR	Small Modular Reactor
SRM	Sustainment, Restoration, and Modernization
SSPP	Strategic Sustainability Performance Plan
SYSCOMS	Navy Systems Commands
UESC	Utility Energy Service Contract
UFC	Unified Facilities Criteria
UP	Utilities Privatization
U.S.	United States
U.S.C	United States Code
USAG	United States Army Garrison
USC	Utility Service Contract
USD(A&S)	Under Secretary of Defense for Acquisition and Sustainment
USMC	United States Marine Corps
USORT	Utility System Outage Report Tracker
VAM	Vehicle Allocation Methodology
VFD	Variable Frequency Drive
WHS	Washington Headquarters Service

Appendix B - Compliance Matrix

	Subsection / Paragraph	Description	FY 2018 AEMRR Chapter / Appendix	Page Number
10 U.S.C. § 2925	(a)	Annual Report Related to Installations Energy Management and Mission Assurance — Not later than 120 days after the end of each fiscal year, the Secretary of Defense shall submit to the congressional defense committees an installation energy report detailing the fulfillment during that fiscal year of the energy performance goals for the Department of Defense under section 2911 of this title, including progress on energy resilience at military installations according to metrics developed by the Secretary. Each report shall contain the following:		
	(a)(1)	A description of the progress made to achieve the goals of the Energy Policy Act of 2005 (Public Law 109–58), section 2911(g) of this title, section 553 of the National Energy Conservation Policy Act (42 U.S.C. 8259b), the Energy Independence and Security Act of 2007 (Public Law 110–140), and the energy performance goals for the Department of Defense during the preceding fiscal year, including progress on energy resilience at military installations according to metrics developed by the Secretary.	**3, 5**	**10-27, 32-42**
	(a)(2)	A description of the energy savings, return on investment, and enhancements to installation mission assurance realized by the fulfillment of the goals described in paragraph (1).	**3, 5**	**10-27, 32-42**
	(a)(3)	Details of all utility outages impacting energy resilience at military installations (excluding planned outages for maintenance reasons), whether caused by on- or off-installation disruptions, including the total number and location of outage, the duration of the outage, the financial impact of the outage, whether or not the mission was impacted, the downtimes (in minutes or hours) these missions can afford based on their mission requirements and risk tolerances, the responsible authority managing the utility, and measure taken to mitigate the outage by the responsible authority.	**3**	**18, 20-21, 24, 26-27**

	Subsection / Paragraph	Description	FY 2018 AEMRR Chapter / Appendix	Page Number
	(a)(4)	Details of a military installation's total energy requirements and critical energy requirements (including critical energy loads in megawatts and the associated downtime tolerances for critical energy loads), and the current energy resilience and emergency backup systems servicing critical energy requirements, including, at a minimum— (A) energy resilience and emergency backup system power requirements; (B) the critical missions, facility, or facilities serviced; (C) system service life; (D) capital, operations, maintenance, and testing costs; and (E) other information the Secretary determines necessary.	**3**	**11**
10 U.S.C. § 2911	(c)(1)	The Secretary of Defense shall submit to the congressional defense committees the energy performance goals for the Department of Defense regarding transportation systems, support systems, utilities, and infrastructure and facilities.	**Appendix C**	**C-2**
	(c)(3)	The Secretary of Defense shall include the energy security and resilience goals of the Department of Defense in the installation energy report submitted under section 2925(a) of this title for fiscal year 2018 and every fiscal year thereafter. In the development of energy security and resilience goals, the Department of Defense shall conform with the definitions of energy security and resilience under this title. The report shall include the amount of critical energy load, together with the level of availability and reliability by fiscal year the Department of Defense deems necessary to achieve energy security and resilience.	**Appendix C**	**C-2**
	(d)(1)	The Secretary of Defense shall develop a comprehensive master plan for the achievement of the energy performance goals of the Department of Defense, as set forth in laws, executive orders, and Department of Defense policies.	**Appendix C**	**C-1-C-2**
10 U.S.C. § 2688	(g)(4)	The Secretary of Defense, in consultation with the Secretaries of the military departments, shall include in the installation energy report submitted under section 2925(a) of this title a description of progress in meeting energy resilience metrics for all conveyance contracts entered into pursuant to this section.	**3**	**13**

	Subsection / Paragraph	Description	FY 2018 AEMRR Chapter / Appendix	Page Number
SASC Report 115-262		The Senate Armed Services Committee "directs the Secretary of Defense to work with the scretaries of the military departments, along with the defense agencies, to conduct an investigation for a central office to accelerate energy resilience project development and implementation. The Secretary should consider equitable representation from the military departments and defense agencies during the review, and consult with the services and defense agencies when providing a recommendation. The review should include, at a minimum, the following: (1) A review of lessons learned from existing service execution offices such as the Navy's Resilient Energy Program Office, the Army's Office of Energy Initiatives, and the Air Force's Office of Energy Assurance; (2) Personnel skills, manning, and resources needed to establish the office; (3) The appropriate organizational reporting structure of such an office; (3) Strategy, mission, and performance goals the office would pursue (to include the scope of projects considered and funding strategy considerations); (5) Recruitment, retention, and training strategy; and (6) Legislative authorities and other recommendation to consider for th establishment of an office to accelerate energy resilience project development.	**Appendix E**	**E-1**
SAC-M Report 115-269		The Committee directs the Secretary to provide a report within 180 days of enactment of this act on the Deaprtment's efforts to address risks to critical energy systems outsdie of DoD property.	**Appendix F**	**F-1**
Section 2880, P.L. 115-91, NDAA of FY 2018		Not later than December 31, 2021, the Secretary of Defense shall certify to the congressional defense committees whether or not at United States military installations in Europe the Department of Defense— (1) has taken significant steps to minimize to the extent practicable the dependency on energy sourced inside the Russian Federation at such installations; and (2) has the ability to sustain mission critical operations during an energy supply disruption.	**Appendix G**	**G-1**

Appendix C - Energy Performance Master Plan

DoD Energy Performance Master Plan

Introduction

> Installation energy is the energy necessary to support the functions of over 500 fixed installations on nearly 29 million acres of land within the United States and internationally. This energy is distinct from operational energy, which consists largely of mobility fuel that is used by operational aircraft, ships, and tanks, as well as generators at forward operating bases.

The Energy Performance Master Plan (hereafter referred to as Master Plan) aligns investments to installation energy objectives, enables consistent Department-wide decision-making, and establishes metrics to evaluate DoD's progress against installation energy performance goals. The Master Plan was established and reported in the FY 2011 AEMRR. The goals outlined in the Master Plan align with the Department's facility energy strategy designed to reduce energy costs and improve the energy resilience of fixed installations. The key elements of the installation energy strategy are (Figure C-1):

- Maximize Efficient Energy Use
- Expand Supply for Mission Assurance
- Enhance Energy Resilience

Figure C-1: Installation Energy Approach

In FY 2011, the then Office of the Deputy Under Secretary of Defense for Installations and Environment (ODUSD(I&E)) developed its first Master Plan with input from DoD Components. OASD(S) is in the process of updating the Master Plan to meet the emerging energy requirements and to address energy security challenges specified in the Secretary of Defense's NDS released in February 2018. The Department's energy performance goals and Master Plan will be updated and reported annually in the AEMRR. DoD Components are required to submit their facility energy investment projections for the Future Years Defense Program (FYDP) as part of their Master Plan submittal. The DoD Components' submissions to the President Budget, investment profile, energy benefit analyses, and narratives will be the basis for any updates of the Master Plan within the AEMRR.

Energy Performance Goals

The DoD energy goals in Tables C-1 and C-2 are set forth by title 42 U.S.C. § 15852(a) and title 10 U.S.C. § 2911(g). These goals focus on renewable energy use. Although energy efficiency is no longer a top priority, the Department remains committed to maximizing the efficient use of energy to free up resources for higher priorities. As the DoD deploys new weapon systems and technology to increase military readiness and lethality as directed in the NDS, a rise in energy demand could occur and subsequently reduce energy efficiency results. With respect to renewable energy, the DoD strives to optimize the use of on-site distributed energy resources from all sources of energy generation to directly improve mission assurance. The type of source is determined by local availability, market conditions, a business case, or mission requirements. As such, the Department is committed to optimizing the effective and efficient use of generating sources.

As of this writing, there are no discreet statutory goals related to energy resilience. Such goals have been requested, and once established, DoD will add these goals into this Energy Performance Master Plan submission. Title 10 U.S.C. § 2911(c)(3) requires DoD to include installation energy security and resilience goals in this report and subsequent AEMRRs. The Department is in the process of establishing metrics to measure energy resilience across the Services in terms of energy availability for critical loads. Once energy resilience metrics are established, the Department will develop an annual energy resilience goal for Services to target.

Table C-1: DoD Energy Performance Goals

Goal	Description	Uniform Measure	Method of Measurement	Metric
Consume More Electric Energy From Renewable Sources 42 U.S.C. § 15852(a)	Increase consumption of renewable energy	Installation renewable energy consumption	Total renewable electricity consumption as a percentage of total facility electricity consumption.	MWH
Produce Or Procure More Energy From Renewable Sources 10 U.S.C. § 2911(g)	Increase deployment of on-base renewable energy to improve energy resilience.	Electric and non-electric renewable energy production and procurement.	Electric and non-electric renewable energy produced or procured compared to total facility electricity consumption.	MWH

Table C-2: Energy Performance Targets

Target	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY25
Consume More Renewable Energy	+5%	+5%	+7.5%	+7.5%	+7.5%	+7.5%	+7.5%	+7.5%	+7.5%	+7.5%	+7.5%
Produce/Procure More Renewable Energy [1]	-	-	-	-	-	-	-	+15%	-	-	+25%
[1]FY 2018 interim target required by title 10 U.S.C. § 2911(g)(2)											

DoD will update this Master Plan periodically to address new information, changes in energy performance goals, and to identify the investments necessary to achieve those goals. DoD's commitment to the energy performance goals also includes compliance with energy statutes, regulations, and EOs. Accordingly, the energy performance goals continue to advance the DoD facility energy mission, vision, and strategy.

Appendix D - DoD Energy Performance Summary

Renewable Electric Energy Requirement per title 42 U.S.C. 15852(a)	Renewable Electricity Use (MWH)	Total Electricity Use (MWH)	Percentage of Facility Electric Use	EPAct 2005 Requirement
Eligible renewable electricity use as a percentage of total electricity use	1,775,346.1	30,180,569.1	5.9%	7.5%

Produce or Procure More Energy From Renewable Sources per title 10 U.S.C. 2911(g)	Renewable Energy Produced/Procured (MWH)	Total Electricity Use (MWH)	Percentage of Facility Electric Use	Compliance Target by 2025
Total renewable energy (electric & non-electric) produced or procured as a percentage of total facility electricity consumption	4,756,540.6	30,180,569.1	15.76%	25.0%

Metering Goals	Cumulative # of Buildings Metered For Electricity	Cumulative % of Appropriate Buildings Metered for Electricity	Cumulative # of Buildings Metered for Natural Gas	Cumulative % of Appropriate Buildings Metered for Natural Gas	Cumulative # of Buildings Metered for Steam	Cumulative % of Appropriate Buildings Metered for Steam
Standard Meters in FY 2018	15,833	27.9%	6,843	28.5%	892	26.5%
Advanced Meters in FY 2018	27,734	48.9%	4,555	19.0%	719	21.4%
Total Meters in FY 2018	43,567	76.7%	11,398	47.5%	1,611	47.9%

Federal Building Energy Efficiency Standards	Percent of New Building Designs	Compliance Target
Percent of new building designs started since beginning in FY 2007 that are 30 percent more energy efficient than relevant code, where life-cycle cost effective (including 8/2012 standards)	97.0%	100.0%

Investments in Energy Management

Sources of Investment	Investment Value (Thou. $)	Anticipated Annual Savings (MMBtus)
Direct obligations for facility energy efficiency improvements	$585,910.8	1,807,673.5
Investment value of ESPC Task/Delivery Orders awarded in fiscal year	$572,057.7	895,882.3
Investment value of UESC Task/Delivery Orders awarded in fiscal year	$49,897.3	212,295.0
TOTAL	**$1,207,865.9**	**2,915,850.8**

	Percent
Total Investment as a percentage of total facility energy cost	35.6%
Financed (ESPC/UESC) investment as a percentage of total facility energy costs	18.3%

Total Installation Energy Consumption and Cost		
Energy Type	BBtus	Cost (thou.)
Electricity	100,603.1	2,498,832.2
Fuel Oil	13,519.8	235,889.9
Natural Gas	70,370.9	433,053.5
LPG	912.6	14,408.1
Coal	6,218.9	30,425.3
Steam	4,351.6	111,438.4
Other	479.2	4,999.9
Renewable Electric, On-site	2,585.2	37,886.2
Renewable Electric Off-Site	1,018.9	13,761.0
Renewable, Other, On-Site	2,313.6	5,440.0
Renewable, Off-Site Green Energy Purchases	458.2	10,928.8
TOTAL	**202,832.0**	**3,397,063.3**

Appendix E - Senate Report 115-262, page 150, accompanying S. 2987, the John S. McCain National Defense Authorization Act (NDAA) for Fiscal Year 2019

Establishment of the energy resilience project development and implementation office

The John S. McCain NDAA displays an understanding of the energy resilience work being done in the defense energy community. The document supports the diverse approaches being taken to enhance energy resilience including technologies, strategies, and financing mechanisms. Financed projects are named in particular as a critical tool for the department's future energy resilience goals. Developing further upon the work being done, the NDAA directs the Secretary of Defense to work to accelerate energy resilience portfolios across the enterprise.

The Senate Armed Services Committee "directs the Secretary of Defense to work with the secretaries of the military departments, along with the defense agencies, to conduct an investigation for a central office to accelerate energy resilience project development and implementation. The Secretary should consider equitable representation from the military departments and defense agencies during the review and consult with the services and defense agencies when providing a recommendation. The review should include, at a minimum, the following: (1) A review of lessons learned from existing service execution offices such as the Navy's Resilient Energy Program Office, the Army's Office of Energy Initiatives, and the Air Force's Office of Energy Assurance; (2) Personnel skills, manning, and resources needed to establish the office; (3) The appropriate organizational reporting structure of such an office; (4) Strategy, mission, and performance goals the office would pursue (to include the scope of projects considered and funding strategy considerations); (5) Recruitment, retention, and training strategy; and (6) Legislative authorities and other recommendation to consider for the establishment of an office to accelerate energy resilience project development."

The OSD plans to closely coordinate with ASN(EI&E), Army OEI, and Air Force OEA to coordinate and successfully execute each of the steps in the review process. OSD understands that these offices actively track energy resilience projects, policies, and needs for each service branch and is well aware of both current and planned work. Leveraging lessons learned from these offices extends to steps two through six and OSD plans to use these lessons to help establish the energy resilience project development and implementation office.

OSD wants to emphasize the value of alternatively financed projects in particular as a critical tool for the success of any energy resilience office. As the NDAA alludes, not only is the budget-neutral aspect of many of these projects valuable, but the partnerships with other private and public institutions allows for the exchange of knowledge and best practices, strengthening the resilience capabilities of all parties. Specifically, OSD is working to better value resilience in more conventional, monetary terms, to facilitate its inclusion in project valuation and planning. Working with industry partners to finance resilience by offsetting the costs with more conventional energy savings has seen success to date, but future projects will benefit by viewing resilience not as an expense but as more of an investment.

Appendix F - Senate Report 115-269, page 8, accompanying S. 3024, the Military Construction, Veterans Affairs, and Related Agencies Appropriations Bill, 2019

Critical energy systems outside DoD property

The Committee directs the Secretary to provide a report within 180 days of enactment of this act on the Department's efforts to address risks to critical energy systems outside of DoD property. It is anticipated that this report will emphasize that OSD views inside/outside the fence energy resilience concerns not as discrete, but as very much interrelated concerns. This perspective is based on an understanding that military installations are, themselves, a resource for surrounding communities and that modern energy systems are inherently large, complex, and connected.

Developing solutions to energy resilience problems is inherently easier for DoD organizations when working on owned property or space, but that does mean that an "islanding" project is also an isolated one. Whether as a hub for emergency response operations, as a shelter, or as an emergency source of electricity, ensuring military buildings are energy resilient against energy disruptions provides a service to the surrounding community as well. Military installations providing services to the community is not a new concept and islanding capability development only serves to strengthen the installation's ability to continue to provide these services throughout an emergency.

Installation islanding capabilities come in a variety of scopes, but all require some form of energy generation and/or storage. Modern islanding projects are feasible as they do not stand by until there is an outage, but rather operate continuously, providing a variety of ancillary services to the grid including demand reduction, peak shaving, and frequency stabilization among others. All of these capabilities provide energy resilience to the utility grid, freeing up or even improving the quality of electricity for others connected to those power lines. Utilities are increasingly willing to pay for these ancillary grid services, strengthening the case for and value of islanding projects.

OSD understands energy resilience is a concern for the commercial energy grid and that it can play a significant role in addressing this problem. DoD has developed relationships with utilities and other organizations and can leverage these relationships to develop energy resilience solutions that benefit both military installations and the surrounding communities. Developing and incorporating energy resilience requirements into project design and even utility contracts is an ongoing line of effort which is promising in its ability to spur action and investment on the part of the utility to maintain and upgrade infrastructure to improve energy resilience. Increasing awareness of energy resilience throughout the DoD continues to elevate these engagements with utilities and strengthen the Department's ability to draft impactful requirements. Continuing to develop best practices and policy in this area promises to enhance energy resilience across the country.

Appendix G - Section 2880 of the NDAA for Fiscal Year 2018 (P.L. 115-91)

Energy security for military installations in Europe

Not later than December 31, 2021, the Secretary of Defense shall certify to the congressional defense committees whether or not at United States military installations in Europe the Department of Defense—

(1) has taken significant steps to minimize to the extent practicable the dependency on energy sourced inside the Russian Federation at such installations; and

(2) has the ability to sustain mission critical operations during an energy supply disruption.

In concert with other energy efficiency and resilience initiatives, DoD is well positioned to address this concern and to minimize energy sourced from the Russian Federation. An overall reduction in energy usage through efficiency measures will allow the DoD to reduce reliance on all energy sources and, as such, free up capacity from preferred sources which can be prioritized over Russia. Additionally, since energy resilience projects focus on sustaining critical mission operations during a disruption, installing local distributed energy generation sources is a common part of the solution. New local distributed energy generation sources can reduce reliance on outside energy sources and could potentially "island" the installation's electrical grid.

Appendix H - Energy Consumption by Installation

Component	Installation Name	State / Country	Gross Square Footage ('000 SF)	Total Site Delivered Energy (BBtu)
AIR FORCE	ABRAHAM LINCOLN CAPITAL AIRPORT	ILLINOIS	332	21.5
AIR FORCE	AIR NATIONAL GUARD READINESS CENTER (ANGRC)	MARYLAND	348	21.1
AIR FORCE	ALPENA COUNTY REGIONAL AIRPORT	MICHIGAN	563	49.3
AIR FORCE	ALTUS AIR FORCE BASE	OKLAHOMA	2,514	290.7
AIR FORCE	ANDERSEN AIR FORCE BASE	GUAM	52	2.9
AIR FORCE	JOINT BASE ANDREWS-NAVAL AIR FACILITY WASHINGTON	MARYLAND	498	38.7
AIR FORCE	ARNOLD AIR STATION	TENNESSEE	2,869	1,498.8
AIR FORCE	ATLANTIC CITY INTERNATIONAL AIRPORT	NEW JERSEY	495	43.9
AIR FORCE	AVIANO AIR BASE	ITALY	4,262	308.5
AIR FORCE	BANGOR INTERNATIONAL AIRPORT (ANG)	MAINE	512	51.5
AIR FORCE	BARKSDALE AIR FORCE BASE	LOUISIANA	5,163	465.8
AIR FORCE	BARNES MUNICIPAL AIRPORT ANG	MASSACHUSETTS	513	41.8
AIR FORCE	BEALE AIR FORCE BASE	CALIFORNIA	3,208	356.8
AIR FORCE	BIRMINGHAM INTERNATIONAL AIRPORT	ALABAMA	379	30.1
AIR FORCE	BOISE AIR TERMINAL (ANG)	IDAHO	566	39.9
AIR FORCE	BRADLEY INTERNATIONAL AIRPORT (ANG)	CONNECTICUT	441	46.2
AIR FORCE	BUCKLEY AIR FORCE BASE	COLORADO	1,684	149.0
AIR FORCE	BUCKLEY AIR FORCE BASE	COLORADO	588	45.0
AIR FORCE	BURLINGTON INTERNATIONAL AIRPORT (ANG)	VERMONT	479	22.1
AIR FORCE	CAMP BLANDING MILITARY RESERVATION (ANG)	FLORIDA	124	3.9
AIR FORCE	CAMP MURRAY ANG STATION	WASHINGTON	235	12.7
AIR FORCE	CAMP PENDLETON MILITARY RESERVATION(ANG)	VIRGINIA	124	4.4
AIR FORCE	CAMP PERRY ANG STATION	OHIO	182	4.7

Component	Installation Name	State / Country	Gross Square Footage ('000 SF)	Total Site Delivered Energy (BBtu)
AIR FORCE	CANNON AIR FORCE BASE	NEW MEXICO	3,276	439.2
AIR FORCE	CHANNEL ISLANDS ANG STATION	CALIFORNIA	345	16.5
AIR FORCE	CHARLOTTE/DOUGLAS INT AIRPORT (ANG)	NORTH CAROLINA	620	26.7
AIR FORCE	CHEYENNE REGIONAL AIRPORT	WYOMING	432	41.7
AIR FORCE	COLUMBUS AIR FORCE BASE	MISSISSIPPI	1,579	146.9
AIR FORCE	DANE COUNTY REGIONAL AIRPORT-TRUAX FIELD	WISCONSIN	475	38.4
AIR FORCE	DAVIS-MONTHAN AIR FORCE BASE	ARIZONA	4,926	348.4
AIR FORCE	DES MOINES INTERNATIONAL AIRPORT ANG	IOWA	417	34.9
AIR FORCE	DOBBINS AIR RESERVE BASE	GEORGIA	1,094	102.4
AIR FORCE	DOVER AIR FORCE BASE	DELAWARE	3,823	446.6
AIR FORCE	DULUTH INTERNATIONAL AIRPORT (ANG)	MINNESOTA	485	59.4
AIR FORCE	DYESS AIR FORCE BASE	TEXAS	3,459	302.3
AIR FORCE	EARECKSON AIR STATION	ALASKA	2,916	680.6
AIR FORCE	EDWARDS AIR FORCE BASE	CALIFORNIA	7,192	782.2
AIR FORCE	EGLIN AIR FORCE BASE	FLORIDA	11,700	1,189.4
AIR FORCE	EIELSON AIR FORCE BASE	ALASKA	299	25.3
AIR FORCE	EIELSON AIR FORCE BASE	ALASKA	4,018	2,073.4
AIR FORCE	ELLINGTON FIELD	TEXAS	493	41.7
AIR FORCE	ELLSWORTH AIR FORCE BASE	SOUTH DAKOTA	4,044	453.8
AIR FORCE	EWVRA SHEPHERD FIELD ANG	WEST VIRGINIA	652	59.4
AIR FORCE	FAIRCHILD AIR FORCE BASE	WASHINGTON	4,011	381.2
AIR FORCE	FAIRCHILD AIR FORCE BASE	WASHINGTON	362	40.1
AIR FORCE	FORBES FIELD ANG	KANSAS	487	41.6
AIR FORCE	FORT SMITH MUNICIPAL AIRPORT ANG	ARKANSAS	418	23.6
AIR FORCE	FORT WAYNE INTERNATIONAL AIRPORT	INDIANA	436	39.9
AIR FORCE	FRANCIS E WARREN AIR FORCE BASE	WYOMING	3,135	332.6
AIR FORCE	FRANCIS S GABRESKI AIRPORT (ANG)	NEW YORK	360	30.8
AIR FORCE	FRESNO YOSEMITE INTERNATIONAL	CALIFORNIA	454	23.4

Component	Installation Name	State / Country	Gross Square Footage ('000 SF)	Total Site Delivered Energy (BBtu)
AIR FORCE	FT INDIANTOWN GAP ANG STATION	PENNSYLVANIA	348	17.3
AIR FORCE	CARSWELL AIR RESERVE STATION	TEXAS	360	12.6
AIR FORCE	GENERAL MITCHELL INTERNATIONAL APT (ANG)	WISCONSIN	383	31.9
AIR FORCE	GENERAL WAYNE A. DOWNING PEORIA INTERNATIONAL AIRPORT (ANG)	ILLINOIS	448	35.3
AIR FORCE	GOODFELLOW AIR FORCE BASE	TEXAS	2,590	227.2
AIR FORCE	GRAND FORKS AIR FORCE BASE	NORTH DAKOTA	2,729	323.3
AIR FORCE	GREAT FALLS IAP ANG	MONTANA	428	36.6
AIR FORCE	GRISSOM AIR RESERVE BASE	INDIANA	1,080	153.3
AIR FORCE	GULFPORT-BILOXI REGIONAL AIRPORT (ANG)	MISSISSIPPI	634	24.0
AIR FORCE	SYRACUSE HANCOCK FIELD ANG	NEW YORK	499	48.3
AIR FORCE	HANSCOM AIR FORCE BASE	MASSACHUSETTS	3,535	421.1
AIR FORCE	HARRISBURG IAP	PENNSYLVANIA	330	25.3
AIR FORCE	HECTOR INTERNATIONAL AIRPORT (ANG)	NORTH DAKOTA	492	34.8
AIR FORCE	HICKAM AIR FORCE BASE	HAWAII	852	32.4
AIR FORCE	HILL AIR FORCE BASE	UTAH	13,492	2,565.6
AIR FORCE	HOLLOMAN AIR FORCE BASE	NEW MEXICO	5,436	502.8
AIR FORCE	HOMESTEAD AIR RESERVE BASE	FLORIDA	1,156	57.7
AIR FORCE	WILLOW GROVE AIR RESERVE STATION	PENNSYLVANIA	517	37.1
AIR FORCE	HULMAN REGIONAL AIRPORT	INDIANA	393	37.8
AIR FORCE	HURLBURT FIELD	FLORIDA	4,855	255.9
AIR FORCE	INCIRLIK AIR BASE ADANA	TURKEY	5,346	283.2
AIR FORCE	JACKSON INTERNATIONAL AIRPORT	MISSISSIPPI	547	54.9
AIR FORCE	JACKSONVILLE IAP ANG	FLORIDA	442	23.6
AIR FORCE	JOINT BASE ANDREWS-NAVAL AIR FACILITY WASHINGTON	MARYLAND	5,505	543.9
AIR FORCE	CHARLESTON AIR FORCE BASE	SOUTH CAROLINA	8,679	757.4
AIR FORCE	JEFFERSON BARRACKS ANG STATION	MISSOURI	210	15.6
AIR FORCE	JOE FOSS FIELD ANG	SOUTH DAKOTA	442	45.0

Component	Installation Name	State / Country	Gross Square Footage ('000 SF)	Total Site Delivered Energy (BBtu)
AIR FORCE	JOINT BASE ELMENDORF-FT RICHARDSON	ALASKA	556	46.5
AIR FORCE	JOINT BASE ELMENDORF-FT RICHARDSON	ALASKA	11,758	1,589.6
AIR FORCE	LANGLEY AIR FORCE BASE	VIRGINIA	11,442	1,168.6
AIR FORCE	MCGUIRE AIR FORCE BASE	NEW JERSEY	12,655	1,154.2
AIR FORCE	JOINT BASE SAN ANTONIO	TEXAS	35,705	3,544.2
AIR FORCE	KADENA AIR BASE	JAPAN	23,898	1,163.3
AIR FORCE	KEESLER AIR FORCE BASE	MISSISSIPPI	6,446	632.7
AIR FORCE	KELLY FIELD ANNEX (LACKLAND AFB)	TEXAS	388	32.0
AIR FORCE	KEY FIELD AIR NATIONAL GUARD	MISSISSIPPI	409	26.7
AIR FORCE	KIRTLAND AIR FORCE BASE	NEW MEXICO	7,318	853.8
AIR FORCE	KIRTLAND AIR FORCE BASE	NEW MEXICO	314	16.9
AIR FORCE	KLAMATH FALLS AIRPORT-KINGSLEY FIELD	OREGON	500	44.3
AIR FORCE	KUNSAN AIR BASE	REPUBLIC OF KOREA	3,610	310.2
AIR FORCE	LAJES FIELD	PORTUGAL	1,552	37.3
AIR FORCE	LAMBERT ST LOUIS IAP ANG	MISSOURI	294	9.5
AIR FORCE	LAUGHLIN AIR FORCE BASE	TEXAS	1,926	92.4
AIR FORCE	LINCOLN MUNICIPAL AIRPORT (ANG)	NEBRASKA	356	32.2
AIR FORCE	LITTLE ROCK AIR FORCE BASE	ARKANSAS	3,506	404.3
AIR FORCE	LITTLE ROCK AIR FORCE BASE	ARKANSAS	315	19.9
AIR FORCE	LOS ANGELES AIR FORCE BASE	CALIFORNIA	1,109	86.7
AIR FORCE	LOUISVILLE INTERNATIONAL AIRPORT - STANDIFORD FIELD	KENTUCKY	417	25.5
AIR FORCE	LUIS MUNOZ MARIN INTERNATIONAL AIRPORT	PUERTO RICO	475	22.2
AIR FORCE	LUKE AIR FORCE BASE	ARIZONA	3,810	271.8
AIR FORCE	MACDILL AIR FORCE BASE	FLORIDA	5,343	541.5
AIR FORCE	MALMSTROM AIR FORCE BASE	MONTANA	3,187	713.5
AIR FORCE	MANSFIELD LAHM AIRPORT ANG	OHIO	448	52.6
AIR FORCE	MARCH AIR RESERVE BASE	CALIFORNIA	2,355	147.4

Component	Installation Name	State / Country	Gross Square Footage ('000 SF)	Total Site Delivered Energy (BBtu)
AIR FORCE	MARCH AIR RESERVE BASE	CALIFORNIA	308	72.7
AIR FORCE	MARTIN STATE AIRPORT ANG	MARYLAND	442	30.9
AIR FORCE	MAXWELL AIR FORCE BASE	ALABAMA	6,081	654.1
AIR FORCE	MCCONNELL AIR FORCE BASE	KANSAS	2,827	318.2
AIR FORCE	MCCONNELL AIR FORCE BASE	KANSAS	529	77.2
AIR FORCE	MCENTIRE JOINT NATIONAL GUARD BASE	SOUTH CAROLINA	442	33.5
AIR FORCE	MCGHEE TYSON AIRPORT	TENNESSEE	881	82.6
AIR FORCE	MCGUIRE AIR FORCE BASE	NEW JERSEY	436	42.9
AIR FORCE	MEMPHIS INTERNATIONAL AIRPORT	TENNESSEE	626	72.8
AIR FORCE	MINNEAPOLIS-ST PAUL IAP-AIR RESERVE STN	MINNESOTA	710	71.5
AIR FORCE	MINNEAPOLIS-ST PAUL IAP-AIR RESERVE STN	MINNESOTA	467	40.3
AIR FORCE	MINOT AIR FORCE BASE	NORTH DAKOTA	4,409	589.4
AIR FORCE	MISAWA AIR BASE	JAPAN	7,575	1,175.7
AIR FORCE	MOFFETT FLD ANG	CALIFORNIA	441	12.6
AIR FORCE	MONTGOMERY REGIONAL AIRPORT (ANG) BASE	ALABAMA	505	33.1
AIR FORCE	MOODY AIR FORCE BASE	GEORGIA	3,222	219.2
AIR FORCE	MORON AIR BASE	SPAIN	741	28.5
AIR FORCE	MOUNTAIN HOME AIR FORCE BASE	IDAHO	2,935	327.7
AIR FORCE	NASHVILLE INTERNATIONAL AIRPORT	TENNESSEE	262	21.7
AIR FORCE	NELLIS AIR FORCE BASE	NEVADA	9,831	880.3
AIR FORCE	NEW CASTLE COUNTY AIRPORT	DELAWARE	339	29.0
AIR FORCE	NEW ORLEANS NAS ANG	LOUISIANA	507	38.2
AIR FORCE	NIAGARA FALLS IAP-AIR RESERVE STATION	NEW YORK	755	81.7
AIR FORCE	NIAGARA FALLS IAP-AIR RESERVE STATION	NEW YORK	183	14.7
AIR FORCE	NORTH HIGHLANDS ANG STATION	CALIFORNIA	133	5.2
AIR FORCE	OFFUTT AIR FORCE BASE	NEBRASKA	6,317	883.7
AIR FORCE	OSAN AIR BASE	REPUBLIC OF KOREA	7,971	625.6
AIR FORCE	OTIS AIR NATIONAL GUARD BASE	MASSACHUSETTS	746	61.6

Component	Installation Name	State / Country	Gross Square Footage ('000 SF)	Total Site Delivered Energy (BBtu)
AIR FORCE	PATRICK AIR FORCE BASE	FLORIDA	6,398	751.5
AIR FORCE	PEASE INTERNATIONAL TRADEPORT	NEW HAMPSHIRE	533	49.9
AIR FORCE	PETERSON AIR FORCE BASE	COLORADO	6,822	1,741.1
AIR FORCE	PITTSBURGH IAP-AIR RESERVE STN	PENNSYLVANIA	569	48.6
AIR FORCE	PITTSBURGH INTERNATIONAL AIRPORT (ANG)	PENNSYLVANIA	450	67.6
AIR FORCE	PORTLAND INTERNATIONAL AIRPORT	OREGON	790	52.5
AIR FORCE	QUONSET STATE AIRPORT ANG	RHODE ISLAND	410	38.1
AIR FORCE	RAF ALCONBURY	UNITED KINGDOM	1,561	143.9
AIR FORCE	RAF CROUGHTON	UNITED KINGDOM	1,097	91.5
AIR FORCE	RAF FAIRFORD	UNITED KINGDOM	1,045	43.3
AIR FORCE	RAF LAKENHEATH	UNITED KINGDOM	7,032	510.9
AIR FORCE	RAF MILDENHALL	UNITED KINGDOM	2,986	274.2
AIR FORCE	RAMSTEIN AIR BASE	GERMANY	14,878	982.1
AIR FORCE	RENO TAHOE INTERNATIONAL AIRPORT	NEVADA	403	25.1
AIR FORCE	RICKENBACKER INTERNATION AIRPORT (ANG)	OHIO	509	47.3
AIR FORCE	ROBINS AIR FORCE BASE	GEORGIA	13,223	1,997.5
AIR FORCE	ROBINS AIR FORCE BASE	GEORGIA	724	53.9
AIR FORCE	ROSECRANS MEMORIAL AIRPORT	MISSOURI	399	26.3
AIR FORCE	SALT LAKE CITY INTERNATIONAL AIRPORT ANG	UTAH	501	43.5
AIR FORCE	SAVANNAH/HILTON HEAD INTERNATIONAL AP	GEORGIA	901	43.9
AIR FORCE	SCHENECTADY COUNTY AIRPORT ANG	NEW YORK	422	38.4
AIR FORCE	SCHRIEVER AIR FORCE BASE	COLORADO	2,291	424.9
AIR FORCE	SCOTT AIR FORCE BASE	ILLINOIS	4,828	592.4
AIR FORCE	SCOTT AIR FORCE BASE	ILLINOIS	354	34.5
AIR FORCE	SELFRIDGE ANG BASE	MICHIGAN	1,627	174.3
AIR FORCE	SEYMOUR JOHNSON AIR FORCE BASE	NORTH CAROLINA	3,124	305.9
AIR FORCE	SHAW AIR FORCE BASE	SOUTH CAROLINA	3,302	302.7
AIR FORCE	SHEPPARD AIR FORCE BASE	TEXAS	7,234	666.2

Component	Installation Name	State / Country	Gross Square Footage ('000 SF)	Total Site Delivered Energy (BBtu)
AIR FORCE	SIOUX GATEWAY AP/COL. BUD DAY FIELD(ANG)	IOWA	432	41.2
AIR FORCE	SKY HARBOR INTERNATIONAL AIRPORT	ARIZONA	276	16.6
AIR FORCE	SPANGDAHLEM AIR BASE	GERMANY	5,124	349.4
AIR FORCE	SPRINGFIELD BECKLEY MUNICIPAL AIRPORT	OHIO	504	43.1
AIR FORCE	STEWART INTERNATIONAL AIRPORT	NEW YORK	868	92.2
AIR FORCE	TINKER AIR FORCE BASE	OKLAHOMA	18,715	2,507.9
AIR FORCE	TOLEDO EXPRESS AIRPORT ANG	OHIO	379	30.7
AIR FORCE	TRAVIS AIR FORCE BASE	CALIFORNIA	6,471	439.7
AIR FORCE	TUCSON INTERNATIONAL AIRPORT	ARIZONA	597	47.4
AIR FORCE	TULSA INTERNATIONAL AIRPORT	OKLAHOMA	384	39.9
AIR FORCE	TYNDALL AIR FORCE BASE	FLORIDA	4,207	324.1
AIR FORCE	USAF ACADEMY	COLORADO	6,702	753.6
AIR FORCE	VANCE AIR FORCE BASE	OKLAHOMA	1,468	141.7
AIR FORCE	VANDENBERG AIR FORCE BASE	CALIFORNIA	5,092	516.9
AIR FORCE	VOLK FIELD	WISCONSIN	668	50.7
AIR FORCE	W K KELLOGG AIRPORT	MICHIGAN	406	55.1
AIR FORCE	WESTOVER AIR RESERVE BASE	MASSACHUSETTS	1,695	173.8
AIR FORCE	WHITEMAN AIR FORCE BASE	MISSOURI	3,781	534.4
AIR FORCE	WILL ROGERS WORLD AIRPORT	OKLAHOMA	403	31.2
AIR FORCE	WRIGHT PATTERSON AIR FORCE BASE	OHIO	16,667	3,035.4
AIR FORCE	YEAGER AIRPORT ANG	WEST VIRGINIA	437	43.9
AIR FORCE	YOKOTA AIR BASE	JAPAN	10,098	1,238.1
AIR FORCE	YOUNGSTOWN-WARREN REGIONAL AIRPORT ARS	OHIO	742	78.4
ARMY	ANNISTON ARMY DEPOT	ALABAMA	9,766	709.8
ARMY	PINE BLUFF ARSENAL	ARKANSAS	3,421	314.3
ARMY	SIERRA ARMY DEPOT	CALIFORNIA	5,348	142.9
ARMY	MILITARY OCEAN TML CONCORD	CALIFORNIA	267	12.2
ARMY	PUEBLO CHEMICAL DEPOT	COLORADO	1,078	33.8

Component	Installation Name	State / Country	Gross Square Footage ('000 SF)	Total Site Delivered Energy (BBtu)
ARMY	IOWA AAP (GOCO)	IOWA	3,814	675.5
ARMY	BLUE GRASS ARMY DEPOT	KENTUCKY	4,203	152.0
ARMY	LAKE CITY AAP (GOCO)	MISSOURI	2,829	1,033.8
ARMY	HAWTHORNE AAP (GOCO)	NEVADA	9,716	141.2
ARMY	WATERVLIET ARSENAL	NEW YORK	2,175	346.9
ARMY	MOT SUNNY POINT	NORTH CAROLINA	352	14.9
ARMY	LIMA JSMC	OHIO	1,614	468.7
ARMY	MCALESTER AAP	OKLAHOMA	10,397	469.0
ARMY	LETTERKENNY ARMY DEPOT	PENNSYLVANIA	5,391	359.7
ARMY	SCRANTON AAP	PENNSYLVANIA	683	443.4
ARMY	TOBYHANNA ARMY DEPOT	PENNSYLVANIA	4,466	548.5
ARMY	HOLSTON AAP (GOCO)	TENNESSEE	1,811	2,748.1
ARMY	MILAN AAP (GOCO)	TENNESSEE	3,318	19.1
ARMY	CORPUS CHRISTI AD	TEXAS	2,746	298.5
ARMY	RED RIVER DEPOT	TEXAS	7,506	854.3
ARMY	TOOELE ARMY DEPOT	UTAH	3,840	76.4
ARMY	RADFORD AAP (GOCO)	VIRGINIA	2,503	2,972.9
ARMY	ALABAMA ARNG	ALABAMA	3,550	239.5
ARMY	ALASKA ARNG	ALASKA	312	146.2
ARMY	ARIZONA ARNG	ARIZONA	1,603	70.1
ARMY	ARKANSAS ARNG	ARKANSAS	4,233	230.2
ARMY	CALIFORNIA ARNG	CALIFORNIA	5,298	190.5
ARMY	COLORADO ARNG	COLORADO	536	75.3
ARMY	CONNECTICUT ARNG	CONNECTICUT	1,265	93.8
ARMY	DELAWARE ARNG	DELAWARE	602	23.8
ARMY	DC ARNG (MOB)	DISTRICT OF COLUMBIA	494	49.8
ARMY	FLORIDA ARNG	FLORIDA	2,865	110.1
ARMY	GEORGIA ARNG	GEORGIA	1,757	117.2

Component	Installation Name	State / Country	Gross Square Footage ('000 SF)	Total Site Delivered Energy (BBtu)
ARMY	HAWAII ARNG	HAWAII	1,123	23.7
ARMY	IDAHO ARNG	IDAHO	812	112.1
ARMY	ILLINOIS ARNG	ILLINOIS	2,666	132.7
ARMY	INDIANA ARNG	INDIANA	4,423	365.1
ARMY	IOWA ARNG	IOWA	3,022	137.0
ARMY	KANSAS ARNG	KANSAS	1,499	106.8
ARMY	KENTUCKY ARNG	KENTUCKY	1,646	61.8
ARMY	LOUISIANA ARNG	LOUISIANA	2,970	179.7
ARMY	MAINE ARNG	MAINE	1,055	47.9
ARMY	MARYLAND ARNG	MARYLAND	1,253	76.9
ARMY	MASSACHUSETTS ARNG	MASSACHUSETTS	1,977	149.9
ARMY	MICHIGAN ARNG	MICHIGAN	3,878	377.7
ARMY	MINNESOTA ARNG	MINNESOTA	4,173	259.8
ARMY	MISSISSIPPI ARNG	MISSISSIPPI	5,762	239.3
ARMY	MISSOURI ARNG	MISSOURI	1,930	144.2
ARMY	MONTANA ARNG	MONTANA	1,364	75.7
ARMY	NEBRASKA ARNG	NEBRASKA	1,573	87.8
ARMY	NEVADA ARNG	NEVADA	566	29.5
ARMY	NEW HAMPSHIRE ARNG	NEW HAMPSHIRE	834	42.6
ARMY	NEW JERSEY ARNG	NEW JERSEY	1,255	139.5
ARMY	NEW MEXICO ARNG	NEW MEXICO	798	72.7
ARMY	NEW YORK ARNG	NEW YORK	2,488	168.1
ARMY	NORTH CAROLINA ARNG	NORTH CAROLINA	1,390	145.8
ARMY	NORTH DAKOTA ARNG	NORTH DAKOTA	1,796	137.7
ARMY	OHIO ARNG	OHIO	3,309	226.1
ARMY	OKLAHOMA ARNG	OKLAHOMA	1,930	127.0
ARMY	OREGON ARNG	OREGON	2,252	110.2
ARMY	PENNSYLVANIA ARNG	PENNSYLVANIA	5,093	329.8

Component	Installation Name	State / Country	Gross Square Footage ('000 SF)	Total Site Delivered Energy (BBtu)
ARMY	RHODE ISLAND ARNG	RHODE ISLAND	1,231	60.8
ARMY	SOUTH CAROLINA ARNG	SOUTH CAROLINA	1,376	116.0
ARMY	SOUTH DAKOTA ARNG	SOUTH DAKOTA	1,109	61.2
ARMY	TENNESSEE ARNG	TENNESSEE	2,298	134.0
ARMY	TEXAS ARNG	TEXAS	3,436	161.4
ARMY	UTAH ARNG	UTAH	1,956	124.6
ARMY	VERMONT ARNG	VERMONT	1,160	59.4
ARMY	VIRGINIA ARNG	VIRGINIA	3,385	208.6
ARMY	WASHINGTON ARNG	WASHINGTON	892	54.0
ARMY	WEST VIRGINIA ARNG	WEST VIRGINIA	2,032	179.5
ARMY	WISCONSIN ARNG	WISCONSIN	2,121	189.7
ARMY	WYOMING ARNG	WYOMING	835	87.8
ARMY	GUAM ARNG (MOB)	GUAM	256	10.5
ARMY	PUERTO RICO ARNG (MOB)	PUERTO RICO	1,472	31.6
ARMY	VIRGIN ISLANDS ARNG (MOB)	VIRGIN ISLANDS	300	9.7
ARMY	REDSTONE ARSENAL	ALABAMA	13,038	1,653.6
ARMY	FORT RUCKER	ALABAMA	5,912	494.0
ARMY	FORT GREELY	ALASKA	1,069	211.1
ARMY	FORT WAINWRIGHT	ALASKA	6,797	1,662.0
ARMY	FORT HUACHUCA	ARIZONA	5,905	424.3
ARMY	YUMA PROVING GROUND	ARIZONA	1,853	144.2
ARMY	FORT IRWIN	CALIFORNIA	4,560	341.2
ARMY	PRESIDIO OF MONTEREY	CALIFORNIA	2,722	168.5
ARMY	FORT CARSON	COLORADO	14,807	1,391.7
ARMY	USAG MIAMI	FLORIDA	782	89.3
ARMY	FORT BENNING	GEORGIA	20,588	1,426.5
ARMY	FORT GORDON	GEORGIA	10,282	854.3
ARMY	FORT STEWART	GEORGIA	15,095	1,009.7

Component	Installation Name	State / Country	Gross Square Footage ('000 SF)	Total Site Delivered Energy (BBtu)
ARMY	USAG HAWAII	HAWAII	14,681	828.2
ARMY	ROCK ISLAND ARSENAL	ILLINOIS	6,644	467.1
ARMY	FORT LEAVENWORTH	KANSAS	4,490	393.7
ARMY	FORT RILEY	KANSAS	11,792	1,042.8
ARMY	FORT CAMPBELL	KENTUCKY	17,284	1,664.7
ARMY	FORT KNOX	KENTUCKY	11,562	929.2
ARMY	FORT POLK	LOUISIANA	7,764	762.7
ARMY	ABERDEEN PG	MARYLAND	14,664	2,759.7
ARMY	FORT DETRICK	MARYLAND	3,471	992.9
ARMY	ADELPHI LABORATORY CTR	MARYLAND	1,168	238.1
ARMY	FORT GEORGE MEADE	MARYLAND	10,633	661.8
ARMY	SOLDIER SYSTEMS CTR, NATICK	MASSACHUSETTS	994	127.8
ARMY	USAG DETROIT ARSENAL	MICHIGAN	1,928	244.3
ARMY	FORT LEONARD WOOD	MISSOURI	12,338	1,486.7
ARMY	PICATINNY ARSENAL	NEW JERSEY	3,332	539.3
ARMY	WHITE SANDS MISSILE RANGE	NEW MEXICO	4,720	261.3
ARMY	FORT DRUM	NEW YORK	12,184	707.2
ARMY	FORT HAMILTON	NEW YORK	686	65.4
ARMY	WEST POINT MIL RESERVATION	NEW YORK	8,168	953.5
ARMY	FORT BRAGG	NORTH CAROLINA	34,228	3,306.9
ARMY	FORT SILL	OKLAHOMA	12,339	1,115.1
ARMY	CARLISLE BARRACKS	PENNSYLVANIA	1,136	128.5
ARMY	FORT JACKSON	SOUTH CAROLINA	10,794	788.3
ARMY	FORT BLISS	TEXAS	22,607	1,134.1
ARMY	FORT HOOD	TEXAS	23,019	1,941.3
ARMY	DUGWAY PROVING GROUND	UTAH	2,073	230.9
ARMY	FORT BELVOIR	VIRGINIA	13,253	1,055.1
ARMY	FORT A P HILL	VIRGINIA	1,521	75.8

Component	Installation Name	State / Country	Gross Square Footage ('000 SF)	Total Site Delivered Energy (BBtu)
ARMY	FORT LEE	VIRGINIA	10,133	804.9
ARMY	JOINT BASE MYER-HENDERSON HALL	VIRGINIA	3,714	428.8
ARMY	JOINT BASE LEWIS MCCHORD	WASHINGTON	26,409	1,993.6
ARMY	USAG BENELUX	BELGIUM	5,586	162.2
ARMY	USAG ANSBACH	GERMANY	7,114	307.8
ARMY	USAG BAVARIA	GERMANY	23,862	1,588.5
ARMY	USAG RHEINLAND-PFALZ	GERMANY	24,690	1,255.8
ARMY	USAG STUTTGART	GERMANY	8,680	585.2
ARMY	USAG WIESBADEN	GERMANY	9,888	565.5
ARMY	USAG VICENZA	ITALY	8,123	608.7
ARMY	CAMP ZAMA JAPAN	JAPAN	10,190	638.3
ARMY	USAG DAEGU	SOUTH KOREA	6,582	446.3
ARMY	USAG RED CLOUD	SOUTH KOREA	9,860	904.8
ARMY	USAG HUMPHREYS	SOUTH KOREA	17,184	1,472.7
ARMY	USAG YONGSAN	SOUTH KOREA	8,293	810.4
ARMY	KWAJALEIN ATOLL	MARSHALL ISLANDS	3,388	914.9
ARMY	81ST RSC	SOUTH CAROLINA	6,045	234.7
ARMY	FORT HUNTER LIGGETT	CALIFORNIA	1,453	32.1
ARMY	63RD RSC	CALIFORNIA	5,880	237.2
ARMY	PARKS CSTC	CALIFORNIA	1,132	46.4
ARMY	DEVENS RFTA	MASSACHUSETTS	1,127	120.2
ARMY	88TH RSC	WISCONSIN	9,457	617.8
ARMY	99TH RSC	NEW JERSEY	7,349	368.3
ARMY	FORT MCCOY	WISCONSIN	6,890	402.8
ARMY	9TH MSC	HAWAII	174	7.2
ARMY	FORT BUCHANAN	PUERTO RICO	1,765	118.9
NAVY	NAVAL STATION GREAT LAKES IL	ILLINOIS	9,528	1,066.9

Component	Installation Name	State / Country	Gross Square Footage ('000 SF)	Total Site Delivered Energy (BBtu)
NAVY	SUBASE NEW LONDON CT	CONNECTICUT	3,165	843.2
NAVY	NAS PENSACOLA FL	FLORIDA	11,573	954.5
NAVY	NAS JRB NEW ORLEANS LA	LOUISIANA	2,283	193.2
NAVY	NAS JACKSONVILLE FL	FLORIDA	8,850	996.2
NAVY	NAS KEY WEST FL	FLORIDA	2,941	264.4
NAVY	NAS CORPUS CHRISTI TX	TEXAS	2,726	199.2
NAVY	NAVBASE SAN DIEGO CA	CALIFORNIA	9,229	1,899.3
NAVY	NAVBASE CORONADO	CALIFORNIA	13,917	1,777.9
NAVY	NAS WHIDBEY ISLAND WA	WASHINGTON	3,894	490.9
NAVY	NAVSUPPACT MIDSOUTH MEMPHIS TN	TENNESSEE	2,784	211.0
NAVY	NAVAL STATION NEWPORT RI	RHODE ISLAND	6,030	614.6
NAVY	NAVSUPPACT MECHANICSBURG PA	PENNSYLVANIA	11,375	552.0
NAVY	NAVSUPPACT NORFOLK NSY	VIRGINIA	7,476	674.3
NAVY	NSY PORTSMOUTH	MAINE	4,455	1,139.4
NAVY	FLEET ACTIVITIES CHINHAE KS	REPUBLIC OF KOREA	419	27.5
NAVY	NAVSUPPACT BETHESDA MD	MARYLAND	7,594	1,161.8
NAVY	CAMP LEMONNIER DJIBOUTI	DJIBOUTI	1,875	917.3
NAVY	NSA ANDERSEN	GUAM	6,706	320.0
NAVY	SUBASE KINGS BAY GA	GEORGIA	5,334	770.5
NAVY	NAVAL AIR STATION PAX RIVER	MARYLAND	8,498	1,029.2
NAVY	NAWS CHINA LAKE	CALIFORNIA	4,666	514.4
NAVY	JNTEXPBASE LITTLE CREEK FS VA	VIRGINIA	5,703	740.3
NAVY	NAVHOSP BEAUFORT SC	SOUTH CAROLINA	431	60.7
NAVY	NAVSUPPACT HAMPTON ROADS VA	VIRGINIA	7,319	905.3
NAVY	NAF EL CENTRO CA	CALIFORNIA	1,194	81.3
NAVY	NAS OCEANA VA	VIRGINIA	8,049	695.7

Component	Installation Name	State / Country	Gross Square Footage ('000 SF)	Total Site Delivered Energy (BBtu)
NAVY	NAVSTA MAYPORT FL	FLORIDA	2,684	464.5
NAVY	NAS KINGSVILLE TX	TEXAS	1,153	119.6
NAVY	NAS FALLON NV	NEVADA	2,188	212.0
NAVY	NAS WHITING FLD MILTON FL	FLORIDA	1,311	96.8
NAVY	NAVSTA GUANTANAMO BAY	DIEGO GARCIA	6,506	1,151.0
NAVY	NAVAL SUPPORT ACTIVITY ORLANDO	FLORIDA	308	22.9
NAVY	NAVAL SUPPORT ACTY PANAMA CITY	FLORIDA	1,546	134.8
NAVY	NSA SARATOGA SPRINGS NY	NEW YORK	40	3.1
NAVY	NAVSUPPDET MONTEREY CA	CALIFORNIA	1,825	134.0
NAVY	NAVAL SUPPORT ACTIVITY CRANE	INDIANA	4,233	760.7
NAVY	COMFLEACT YOKOSUKA JA	JAPAN	12,869	3,001.8
NAVY	COMFLEACT OKINAWA JA	JAPAN	844	60.8
NAVY	NAF ATSUGI JA	JAPAN	4,204	583.2
NAVY	COMFLEACT SASEBO JA	JAPAN	4,480	498.1
NAVY	NAF MISAWA JA	JAPAN	907	82.6
NAVY	CNIC PMRF BARKING SANDS	HAWAII	595	86.0
NAVY	NAVWPNSTA SEAL BEACH	CALIFORNIA	2,033	80.9
NAVY	CNI NAVMAG INDIAN ISLAND	WASHINGTON	376	18.4
NAVY	SINGAPORE AREA COORDINATOR	SINGAPORE	1,157	42.1
NAVY	JBAB ANACOSTIA BOLLING	DISTRICT OF COLUMBIA	3,490	415.7
NAVY	NSA SOUTH POTOMAC	VIRGINIA	6,461	1,410.5
NAVY	NAVSUPPACT ANNAPOLIS	MARYLAND	6,023	692.9
NAVY	NAVBASE GUAM	GUAM	10,091	581.7
NAVY	NAVSUPPACT NAPLES IT	ITALY	5,664	367.2
NAVY	CBC GULFPORT MS	MISSISSIPPI	4,634	142.0
NAVY	NAVSTA NORFOLK VA	VIRGINIA	15,513	3,836.4

Component	Installation Name	State / Country	Gross Square Footage ('000 SF)	Total Site Delivered Energy (BBtu)
NAVY	JBPHH PEARL HARBOR - HICKAM HAWAII	HAWAII	21,110	1,677.4
NAVY	NAVSTA ROTA SP	SPAIN	3,721	260.8
NAVY	NAS SIGONELLA IT	ITALY	3,075	198.3
NAVY	NAVSUPPACT BAHRAIN	BAHRAIN	2,775	263.4
NAVY	NAS LEMOORE CA	CALIFORNIA	3,854	421.2
NAVY	NAS MERIDIAN MS	MISSISSIPPI	1,602	154.3
NAVY	NAVBASE POINT LOMA	CALIFORNIA	6,605	421.3
NAVY	FRC EAST CHERRY POINT NC	NC	2,036	673.0
NAVY	NAVSUPPACT SOUDA BAY GR	GREECE	514	28.9
NAVY	NAVAL BASE KITSAP BREMERTON WA	WASHINGTON	15,228	2,866.2
NAVY	NAVAL SUPPORT ACTIVITY WASH	DISTRICT OF COLUMBIA	9,776	1,854.9
NAVY	NAVSUPPFAC DIEGO GARCIA IO	GUANTANOMO BAY	2,325	928.3
NAVY	NAVSTA EVERETT WA	WASHINGTON	1,839	313.6
NAVY	NAVAL WEAPONS STATION YORKTOWN	VIRGINIA	6,093	213.8
NAVY	NAVAL WEAPONS STATION EARLE NJ	NEW JERSEY	1,240	160.6
NAVY	NAVBASE VENTURA CTY PT MUGU CA	CALIFORNIA	9,296	345.7
NAVY	NAS JRB FT WORTH TX	TEXAS	3,344	268.6
MARINE CORPS	MCAS BEAUFORT SC	SOUTH CAROLINA	3,045	191.5
MARINE CORPS	MCAS CHERRY POINT NC	NORTH CAROLINA	6,622	760.7
MARINE CORPS	MCAS IWAKUNI JA	JAPAN	9,124	954.0
MARINE CORPS	MCAS MIRAMAR	CALIFORNIA	6,461	322.6
MARINE CORPS	MCAS YUMA AZ	ARIZONA	3,295	199.2
MARINE CORPS	MCB CAMP LEJEUNE NC	NORTH CAROLINA	27,385	2,000.6
MARINE CORPS	MCB CAMP PENDLETON CA	CALIFORNIA	20,928	958.4
MARINE CORPS	MCB CAMP S D BUTLER OKINAWA JA	JAPAN	18,901	947.7
MARINE CORPS	MCB HAWAII KANEOHE	HAWAII	7,430	309.2

Component	Installation Name	State / Country	Gross Square Footage ('000 SF)	Total Site Delivered Energy (BBtu)
MARINE CORPS	MCLB ALBANY GA	GEORGIA	6,995	223.9
MARINE CORPS	MCLB BARSTOW CA	CALIFORNIA	4,637	233.2
MARINE CORPS	MARCORCRUITDEP PARRIS ISLAND SC	SOUTH CAROLINA	3,640	450.1
MARINE CORPS	MCSF BLOUNT ISLAND	FLORIDA	978	32.1
MARINE CORPS	MARCORPRCUITDEP SAN DIEGO CA	CALIFORNIA	2,718	134.1
MARINE CORPS	MARCORPS DIST 1 GARDEN CITY NY	NEW YORK	174	31.1
MARINE CORPS	MARFORRES NEW ORLEANS	LOUISIANA	1,895	133.2
MARINE CORPS	MARINE CORPS BASE QUANTICO VA	VIRGINIA	7,695	903.8
MARINE CORPS	MCAGCC TWENTYNINE PALMS CA	CALIFORNIA	6,896	1,166.5
MARINE CORPS	MARBKS WASHINGTON DC	DISTRICT OF COLUMBIA	526	47.7
MARINE CORPS	CAMP MUJUK REPUBLIC OF KOREA	REPUBLIC OF KOREA	292	29.6
MARINE CORPS	CATC CAMP FUJI JA	JAPAN	641	72.0
MARINE CORPS	NAVAL HOSPITAL 29 PALMS CA	CALIFORNIA	233	26.1
MARINE CORPS	MCAS FUTENMA JA	JAPAN	2,060	122.0
MARINE CORPS	MCMWTC BRIDGEPORT CA	CALIFORNIA	368	48.1
MARINE CORPS	MCAS CAMP PENDLETON CA	CALIFORNIA	1,220	60.6
MARINE CORPS	NAVAL HOSPITAL CAMP LEJEUNE NC	NORTH CAROLINA	938	148.2
MARINE CORPS	NAVAL HOSPITAL CAMP PENDLETON CA	CALIFORNIA	926	127.1
MARINE CORPS	NAVAL HOSPITAL OKINAWA JA	JAPAN	761	147.6
DCMA	DCMA CLEVELAND	OHIO	78	9.3
DCMA	DCMA CARSON	CALIFORNIA	85	8.5
DECA	ABERDEEN PROVING GROUND	MARYLAND	62	7.5
DECA	MCLB ALBANY GA	GEORGIA	37	5.6
DECA	ALTUS AIR FORCE BASE	OKLAHOMA	58	8.2
DECA	JOINT BASE ELMENDORF-FT RICHARDSON	ALASKA	105	13.5
DECA	NSA ANDERSEN	GUAM	122	10.7

Component	Installation Name	State / Country	Gross Square Footage ('000 SF)	Total Site Delivered Energy (BBtu)
DECA	JOINT BASE ANDREWS-NAVAL AIR FACILITY WASHINGTON	MARYLAND	113	17.0
DECA	NAVSUPPACT ANNAPOLIS	MARYLAND	48	6.8
DECA	US ARMY GARRISON ANSBACH	GERMANY	58	11.3
DECA	ARNOLD AIR STATION	TENNESSEE	23	4.2
DECA	NAF ATSUGI JA	JAPAN	32	4.7
DECA	AVIANO AIR BASE	ITALY	64	7.0
DECA	BANGOR INTERNATIONAL AIRPORT (ANG)	MAINE	29	4.9
DECA	NAVAL BASE KITSAP BREMERTON WA	WASHINGTON	61	9.1
DECA	BARKSDALE AIR FORCE BASE	LOUISIANA	104	11.1
DECA	MCLB BARSTOW CA	CALIFORNIA	22	3.1
DECA	US ARMY GARRISON BAUMHOLDER	GERMANY	32	5.8
DECA	BEALE AIR FORCE BASE	CALIFORNIA	75	6.6
DECA	JBAB ANACOSTIA BOLLING	DISTRICT OF COLUMBIA	72	10.5
DECA	NAVAL BASE KITSAP BREMERTON WA	WASHINGTON	48	8.6
DECA	MCAGCC TWENTYNINE PALMS CA	CALIFORNIA	13	2.0
DECA	BUCKLEY AIR FORCE BASE	COLORADO	77	9.6
DECA	CAMP HENRY	REPUBLIC OF KOREA	8	1.1
DECA	CAMP CASEY	REPUBLIC OF KOREA	17	2.9
DECA	MCB CAMP S D BUTLER OKINAWA JA	JAPAN	31	5.5
DECA	MCB CAMP S D BUTLER OKINAWA JA	JAPAN	59	7.7
DECA	CAMP HUMPHREYS	REPUBLIC OF KOREA	90	5.1
DECA	MCB CAMP S D BUTLER OKINAWA JA	JAPAN	31	5.3
DECA	CAMP ZAMA	JAPAN	2	0.6
DECA	MCB CAMP LEJEUNE NC	NORTH CAROLINA	76	8.5

Component	Installation Name	State / Country	Gross Square Footage ('000 SF)	Total Site Delivered Energy (BBtu)
DECA	FORT BENNING	GEORGIA	3	0.4
DECA	MCB CAMP PENDLETON CA	CALIFORNIA	113	13.6
DECA	CAMP RED CLOUD	REPUBLIC OF KOREA	11	1.9
DECA	CAMP ZAMA	JAPAN	13	1.7
DECA	CANNON AIR FORCE BASE	NEW MEXICO	58	6.3
DECA	CARLISLE BARRACKS	PENNSYLVANIA	60	5.9
DECA	CHARLESTON AIR FORCE BASE	SOUTH CAROLINA	86	11.8
DECA	CHARLESTON AIR FORCE BASE	SOUTH CAROLINA	64	10.1
DECA	MCAS CHERRY POINT NC	NORTH CAROLINA	59	7.0
DECA	US ARMY GARRISON BENELUX	BELGIUM	46	8.4
DECA	NAWS CHINA LAKE	CALIFORNIA	24	2.9
DECA	FLEET ACTIVITIES CHINHAE KS	REPUBLIC OF KOREA	11	2.1
DECA	COLUMBUS AIR FORCE BASE	MISSISSIPPI	49	4.4
DECA	NAS CORPUS CHRISTI TX	TEXAS	46	7.4
DECA	NAVAL SUPPORT ACTIVITY CRANE	INDIANA	8	1.1
DECA	CAMP HENRY	REPUBLIC OF KOREA	38	4.3
DECA	CAMP HENRY	REPUBLIC OF KOREA	16	1.5
DECA	NSA SOUTH POTOMAC	VIRGINIA	15	2.2
DECA	DAVIS-MONTHAN AIR FORCE BASE	ARIZONA	115	12.9
DECA	RAMSTEIN AIR BASE	GERMANY	37	1.9
DECA	FORT LEE	VIRGINIA	242	26.8
DECA	BEALE AIR FORCE BASE	CALIFORNIA	37	8.3
DECA	DOVER AIR FORCE BASE	DELAWARE	78	5.6
DECA	DUGWAY PROVING GROUND	UTAH	18	2.7
DECA	DYESS AIR FORCE BASE	TEXAS	80	5.2

Component	Installation Name	State / Country	Gross Square Footage ('000 SF)	Total Site Delivered Energy (BBtu)
DECA	EDWARDS AIR FORCE BASE	CALIFORNIA	60	5.7
DECA	EGLIN AIR FORCE BASE	FLORIDA	107	14.9
DECA	EIELSON AIR FORCE BASE	ALASKA	42	6.6
DECA	NAF EL CENTRO CA	CALIFORNIA	13	2.3
DECA	ELLSWORTH AIR FORCE BASE	SOUTH DAKOTA	72	9.4
DECA	FRANCIS E WARREN AIR FORCE BASE	WYOMING	77	6.4
DECA	FAIRCHILD AIR FORCE BASE	WASHINGTON	85	11.2
DECA	NAS FALLON NV	NEVADA	40	3.2
DECA	FORT DETRICK	MARYLAND	58	7.4
DECA	FORT BELVOIR	VIRGINIA	142	20.6
DECA	FORT BENNING	GEORGIA	118	20.2
DECA	FORT BLISS	TEXAS	123	13.2
DECA	FORT BRAGG	NORTH CAROLINA	95	11.7
DECA	FORT BRAGG	NORTH CAROLINA	118	14.7
DECA	FORT BUCHANAN	PUERTO RICO	95	12.2
DECA	FORT CAMPBELL	KENTUCKY	122	15.1
DECA	FORT CARSON	COLORADO	122	16.5
DECA	FORT DETRICK	MARYLAND	39	6.7
DECA	FORT DRUM	NEW YORK	83	13.4
DECA	LANGLEY AIR FORCE BASE	VIRGINIA	103	11.4
DECA	FORT GORDON	GEORGIA	92	11.7
DECA	FORT GREELY	ALASKA	25	5.3
DECA	FORT HAMILTON	NEW YORK	50	9.2
DECA	FORT HOOD	TEXAS	128	19.8
DECA	FORT HOOD	TEXAS	106	9.2
DECA	FORT HUACHUCA	ARIZONA	78	7.8

Component	Installation Name	State / Country	Gross Square Footage ('000 SF)	Total Site Delivered Energy (BBtu)
DECA	COMBAT SUPPORT TRAINING CENTER AND CAMP PARKS	CALIFORNIA	8	1.6
DECA	NATIONAL TRAINING CENTER AND FORT IRWIN	CALIFORNIA	57	8.0
DECA	FORT JACKSON	SOUTH CAROLINA	130	12.2
DECA	FORT KNOX	KENTUCKY	122	12.4
DECA	FORT LEAVENWORTH	KANSAS	74	12.7
DECA	FORT LEE	VIRGINIA	81	12.0
DECA	FORT LEONARD WOOD	MISSOURI	71	11.2
DECA	JOINT BASE LEWIS-MCCHORD	WASHINGTON	105	11.9
DECA	FORT MCCOY	WISCONSIN	16	4.1
DECA	FORT GEORGE G MEADE	MARYLAND	118	15.2
DECA	JOINT BASE MYER-HENDERSON HALL	VIRGINIA	74	8.2
DECA	FORT POLK	LOUISIANA	82	12.0
DECA	FORT RILEY	KANSAS	113	15.9
DECA	FORT RUCKER	ALABAMA	84	8.8
DECA	JBSA - FORT SAM HOUSTON	TEXAS	104	14.4
DECA	FORT SILL	OKLAHOMA	102	15.2
DECA	FORT STEWART	GEORGIA	95	12.2
DECA	FORT WAINWRIGHT	ALASKA	104	21.7
DECA	NAS JRB FT WORTH TX	TEXAS	93	15.4
DECA	US ARMY GARRISON GRAFENWOEHR	GERMANY	14	1.0
DECA	US ARMY GARRISON HEIDELBERG	GERMANY	789	39.0
DECA	GOODFELLOW AIR FORCE BASE	TEXAS	57	7.2
DECA	US ARMY GARRISON GRAFENWOEHR	GERMANY	55	11.1
DECA	GRAND FORKS AIR FORCE BASE	NORTH DAKOTA	41	4.3
DECA	NAVAL STATION GREAT LAKES IL	ILLINOIS	60	9.1
DECA	NAVBASE GUAM	GUAM	57	8.8

Component	Installation Name	State / Country	Gross Square Footage ('000 SF)	Total Site Delivered Energy (BBtu)
DECA	NAVBASE GUAM	GUAM	187	16.3
DECA	CBC GULFPORT MS	MISSISSIPPI	31	6.8
DECA	MAXWELL AIR FORCE BASE	ALABAMA	42	6.1
DECA	HANSCOM AIR FORCE BASE	MASSACHUSETTS	73	11.1
DECA	COMFLEACT SASEBO JA	JAPAN	24	3.4
DECA	88TH REGIONAL SUPPORT COMMAND	INDIANA	54	7.8
DECA	JBPHH PEARL HARBOR - HICKAM HAWAII	HAWAII	115	12.8
DECA	HILL AIR FORCE BASE	UTAH	87	10.3
DECA	US ARMY GARRISON HOHENFELS	GERMANY	38	5.4
DECA	HOLLOMAN AIR FORCE BASE	NEW MEXICO	69	3.5
DECA	FORT STEWART	GEORGIA	58	7.1
DECA	EGLIN AIR FORCE BASE	FLORIDA	63	11.8
DECA	NAVBASE CORONADO	CALIFORNIA	78	14.0
DECA	INCIRLIK AIR BASE ADANA	TURKEY	67	6.2
DECA	MCAS IWAKUNI JA	JAPAN	54	10.5
DECA	INCIRLIK AIR BASE ADANA	TURKEY	15	1.4
DECA	NAS JACKSONVILLE FL	FLORIDA	114	13.0
DECA	YONGSAN GARRISON	REPUBLIC OF KOREA	7	1.7
DECA	KADENA AIR BASE	JAPAN	87	15.5
DECA	RAMSTEIN AIR BASE	GERMANY	178	24.1
DECA	MCB HAWAII KANEOHE	HAWAII	77	12.7
DECA	COMFLEACT YOKOSUKA JA	JAPAN	96	15.3
DECA	CAMP ZAMA	JAPAN	186	8.5
DECA	KEESLER AIR FORCE BASE	MISSISSIPPI	98	16.1
DECA	US ARMY GARRISON STUTTGART	GERMANY	18	1.5
DECA	NAS KEY WEST FL	FLORIDA	21	2.8

Component	Installation Name	State / Country	Gross Square Footage ('000 SF)	Total Site Delivered Energy (BBtu)
DECA	SUBASE KINGS BAY GA	GEORGIA	53	7.5
DECA	NAS KINGSVILLE TX	TEXAS	15	2.3
DECA	KIRTLAND AIR FORCE BASE	NEW MEXICO	108	10.5
DECA	KUNSAN AIR BASE	REPUBLIC OF KOREA	16	4.1
DECA	JBSA - LACKLAND	TEXAS	117	15.7
DECA	LAJES FIELD	PORTUGAL	58	3.5
DECA	MCGUIRE AIR FORCE BASE	NEW JERSEY	18	1.6
DECA	LANGLEY AIR FORCE BASE	VIRGINIA	103	16.5
DECA	LAUGHLIN AIR FORCE BASE	TEXAS	75	4.9
DECA	NAS LEMOORE CA	CALIFORNIA	44	5.7
DECA	JNTEXPBASE LITTLE CREEK FS VA	VIRGINIA	100	11.9
DECA	LITTLE ROCK AIR FORCE BASE	ARKANSAS	100	8.5
DECA	US ARMY GARRISON LIVORNO	ITALY	26	3.4
DECA	LOS ANGELES AIR FORCE BASE	CALIFORNIA	75	8.2
DECA	LUKE AIR FORCE BASE	ARIZONA	102	10.4
DECA	MACDILL AIR FORCE BASE	FLORIDA	171	12.9
DECA	MALMSTROM AIR FORCE BASE	MONTANA	68	7.2
DECA	MARCH AIR RESERVE BASE	CALIFORNIA	117	11.0
DECA	MAXWELL AIR FORCE BASE	ALABAMA	87	13.4
DECA	NAVSTA MAYPORT FL	FLORIDA	71	9.0
DECA	JOINT BASE LEWIS-MCCHORD	WASHINGTON	148	13.8
DECA	BEALE AIR FORCE BASE	CALIFORNIA	88	13.4
DECA	MCCONNELL AIR FORCE BASE	KANSAS	56	7.1
DECA	MCGUIRE AIR FORCE BASE	NEW JERSEY	103	14.3
DECA	NAVSUPPACT MIDSOUTH MEMPHIS TN	TENNESSEE	61	11.3
DECA	NAS MERIDIAN MS	MISSISSIPPI	32	5.1

Component	Installation Name	State / Country	Gross Square Footage ('000 SF)	Total Site Delivered Energy (BBtu)
DECA	MINOT AIR FORCE BASE	NORTH DAKOTA	56	10.0
DECA	MCAS MIRAMAR	CALIFORNIA	91	11.4
DECA	MISAWA AIR BASE	JAPAN	82	10.4
DECA	NAVSUBASE NEW LONDON CT	CONNECTICUT	28	3.7
DECA	CSO NAS MOFFETT FIELD CA	CALIFORNIA	52	3.1
DECA	MOODY AIR FORCE BASE	GEORGIA	64	8.8
DECA	MOUNTAIN HOME AIR FORCE BASE	IDAHO	54	5.5
DECA	NAVSUPPACT NAPLES IT	ITALY	85	14.4
DECA	NELLIS AIR FORCE BASE	NEVADA	130	8.7
DECA	NAVSUBASE NEW LONDON CT	CONNECTICUT	57	9.4
DECA	NAS JRB NEW ORLEANS LA	LOUISIANA	47	7.0
DECA	MCB CAMP LEJEUNE NC	NORTH CAROLINA	46	6.5
DECA	NAVAL STATION NEWPORT RI	RHODE ISLAND	46	7.0
DECA	NAVSTA NORFOLK VA	VIRGINIA	79	10.5
DECA	NAVBASE CORONADO	CALIFORNIA	46	7.0
DECA	NAS OCEANA VA	VIRGINIA	110	15.1
DECA	OFFUTT AIR FORCE BASE	NEBRASKA	120	18.7
DECA	MCB CAMP S D BUTLER OKINAWA JA	JAPAN	291	11.2
DECA	PRESIDIO OF MONTEREY	CALIFORNIA	111	9.5
DECA	OSAN AIR BASE	REPUBLIC OF KOREA	60	5.4
DECA	OSAN AIR BASE	REPUBLIC OF KOREA	49	5.2
DECA	US ARMY GARRISON STUTTGART	GERMANY	5	2.4
DECA	MCRD BEAUFORT PI SC	SOUTH CAROLINA	44	3.4
DECA	US ARMY GARRISON STUTTGART	GERMANY	64	8.6
DECA	PATRICK AIR FORCE BASE	FLORIDA	103	8.4
DECA	NAVAL AIR STATION PAX RIVER	MARYLAND	56	7.3

Component	Installation Name	State / Country	Gross Square Footage ('000 SF)	Total Site Delivered Energy (BBtu)
DECA	JBPHH PEARL HARBOR - HICKAM HAWAII	HAWAII	98	11.2
DECA	NAS PENSACOLA FL	FLORIDA	74	11.9
DECA	PETERSON AIR FORCE BASE	COLORADO	102	12.2
DECA	PICATINNY ARSENAL	NEW JERSEY	22	4.2
DECA	99TH REGIONAL SUPPORT COMMAND	PENNSYLVANIA	43	7.5
DECA	NAVBASE VENTURA CTY PT MUGU CA	CALIFORNIA	65	7.3
DECA	NAVSUPPACT NORFOLK NSY	VIRGINIA	62	9.0
DECA	NSY PORTSMOUTH	MAINE	28	5.8
DECA	MARINE CORPS BASE QUANTICO VA	VIRGINIA	121	15.2
DECA	RAF ALCONBURY	UNITED KINGDOM	77	10.5
DECA	RAF CROUGHTON	UNITED KINGDOM	20	3.1
DECA	RAF LAKENHEATH	UNITED KINGDOM	112	18.4
DECA	RAF MENWITH HILL	UNITED KINGDOM	34	4.7
DECA	RAF MILDENHALL	UNITED KINGDOM	14	2.2
DECA	RAMSTEIN AIR BASE	GERMANY	95	13.9
DECA	RAMSTEIN AIR BASE	GERMANY	41	10.1
DECA	JBSA - RANDOLPH	TEXAS	97	14.9
DECA	REDSTONE ARSENAL	ALABAMA	81	11.8
DECA	MCSPTACT KANSAS CITY MO	MISSOURI	24	3.1
DECA	ROBINS AIR FORCE BASE	GEORGIA	70	10.1
DECA	US ARMY GARRISON STUTTGART	GERMANY	41	5.6
DECA	ROCK ISLAND ARSENAL	ILLINOIS	33	2.9
DECA	NAVSTA ROTA SP	SPAIN	50	6.7
DECA	CAMP ZAMA	JAPAN	67	5.9
DECA	NAVBASE SAN DIEGO CA	CALIFORNIA	128	16.8
DECA	MCB CAMP PENDLETON CA	CALIFORNIA	20	3.0
DECA	NSA SARATOGA SPRINGS NY	NEW YORK	22	3.7

Component	Installation Name	State / Country	Gross Square Footage ('000 SF)	Total Site Delivered Energy (BBtu)
DECA	COMFLEACT SASEBO JA	JAPAN	20	2.3
DECA	US ARMY GARRISON SCHINNEN	NETHERLANDS	24	5.1
DECA	SCHOFIELD BARRACKS	HAWAII	92	13.5
DECA	SCOTT AIR FORCE BASE	ILLINOIS	114	18.2
DECA	SELFRIDGE ANG BASE	MICHIGAN	76	7.9
DECA	SEYMOUR JOHNSON AIR FORCE BASE	NORTH CAROLINA	66	9.1
DECA	SHAW AIR FORCE BASE	SOUTH CAROLINA	61	8.6
DECA	SHEPPARD AIR FORCE BASE	TEXAS	81	9.2
DECA	NAS SIGONELLA IT	ITALY	68	10.3
DECA	NAVSTA EVERETT WA	WASHINGTON	60	7.4
DECA	SPANGDAHLEM AIR BASE	GERMANY	54	8.3
DECA	TINKER AIR FORCE BASE	OKLAHOMA	87	10.8
DECA	TOBYHANNA ARMY DEPOT	PENNSYLVANIA	22	3.2
DECA	TRAVIS AIR FORCE BASE	CALIFORNIA	97	14.8
DECA	MCAGCC TWENTYNINE PALMS CA	CALIFORNIA	57	7.5
DECA	TYNDALL AIR FORCE BASE	FLORIDA	76	8.7
DECA	USAF ACADEMY	COLORADO	67	8.8
DECA	VANCE AIR FORCE BASE	OKLAHOMA	34	5.2
DECA	VANDENBERG AIR FORCE BASE	CALIFORNIA	83	5.8
DECA	US ARMY GARRISON VICENZA	ITALY	55	8.8
DECA	US ARMY GARRISON GRAFENWOEHR	GERMANY	52	6.4
DECA	RAMSTEIN AIR BASE	GERMANY	59	11.2
DECA	WEST POINT MILITARY RESERVATION	NEW YORK	73	12.4
DECA	NAS WHIDBEY ISLAND WA	WASHINGTON	66	9.7
DECA	WHITE SANDS MISSILE RANGE	NEW MEXICO	32	4.2
DECA	WHITEMAN AIR FORCE BASE	MISSOURI	61	8.4
DECA	NAS WHITING FLD MILTON FL	FLORIDA	22	4.3

Component	Installation Name	State / Country	Gross Square Footage ('000 SF)	Total Site Delivered Energy (BBtu)
DECA	US ARMY GARRISON WIESBADEN	GERMANY	62	10.5
DECA	WRIGHT PATTERSON AIR FORCE BASE	OHIO	123	14.2
DECA	COMFLEACT YOKOSUKA JA	JAPAN	86	15.2
DECA	YOKOTA AIR BASE	JAPAN	81	19.8
DECA	YONGSAN GARRISON	REPUBLIC OF KOREA	94	15.5
DECA	YONGSAN GARRISON	REPUBLIC OF KOREA	89	2.0
DECA	MCAS YUMA AZ	ARIZONA	34	4.6
DECA	YUMA PROVING GROUND	ARIZONA	23	2.3
DFAS	DFAS ROME	NEW YORK	332	131.2
DFAS	DFAS LIMESTONE	MAINE	141	9.1
DLA	DEFENSE SUPPLY CENTER COLUMBUS	OHIO	3,841	304.8
DLA	DEFENSE DISTRIBUTION DEPOT SAN JOAQUIN	CALIFORNIA	5,279	106.5
DLA	DEFENSE SUPPLY CENTER RICHMOND	VIRGINIA	4,414	251.9
DLA	DEFENSE DISTRIBUTION DEPOT SUSQUEHANNA	PENNSYLVANIA	7,611	334.9
NGA	NGA	VIRGINIA	6,653	695.9
NRO	BUCKLEY AIR FORCE BASE	COLORADO	1,255	343.2
NRO	FORT BELVOIR	VIRGINIA	1,454	375.3
NRO	WHITE SANDS MISSILE RANGE	NEW MEXICO	235	81.9
NRO	PATRICK AIR FORCE BASE	FLORIDA	760	63.4
NRO	VANDENBERG AIR FORCE BASE	CALIFORNIA	435	23.3
NRO	NRO HEADQUARTERS	VIRGINIA	1,520	176.0
NSA	FORT GEORGE G MEADE	MARYLAND	15	4,242.9
WHS	WASHINGTON HQS SERVICE	VIRGINIA	6,971	980.0
WHS	MARK CENTER	VIRGINIA	1,876	109.2

Appendix I - References

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